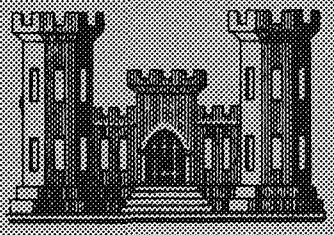
WATER RESOURCES INVESTIGATION

SECTION 22:
COOPERATION WITH THE STATES

MILLER RUN and AYERS BROOK
VERMONT
CONNECTICUT RIVER BASIN

SITUATION REPORT



Department of the Army
New England Division, Corps of Engineers
Waltham, Massachusetts

SEPTEMBER 1976

WATER RESOURCES INVESTIGATION

MILLER RUN, LYNDON, VERMONT

AYERS BROOK, RANDOLPH, VERMONT

CONNECTICUT RIVER BASIN

Situation Report

Department of the Army
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THE STUDY AND REPORT

PURPOSE OF STUDY

The State of Vermont has requested that the Corps of Engineers provide technical assistance in identifying potential problem areas within two watersheds in Vermont, namely the Miller Run watershed in Lyndon and the Ayers Brook watershed in Randolph.

The purpose of this study was to provide the State of Vermont with a "working document" which categorizes and catalogues water resources problems in the two watersheds. It is intended that this report be used as a planning tool for accomplishing preventive and remedial measures as State resources become available. In addition, the location and relative size of gravel and sand deposits are listed should stream harvesting be undertaken by the State or local interests. Also, this report may serve as a guide should emergency conditions require immediate attention.

Provisions for assistance by the Corps of Engineers in such an investigation are contained in Section 22 of the 1974 Water Resources Development Act (Public Law 93-251) which states that:

"(a) The Secretary of the Army, acting through the Chief of Engineers, is authorized to cooperate with any State in the preparation of comprehensive plans for the development, utilization, and conservation of the water and related resources of drainage basins located within the boundaries of such State and to submit to Congress reports and recommendations with respect to appropriate Federal participation in carrying out such plans!"

SCOPE OF THE STUDY

This report presents the results of our water resources investigation of the Miller Run and Ayers Brook watersheds in Vermont. Emphasis, based on discussions with Vermont officials, was placed on identifying flood problems, erosion areas and sand and gravel deposits. General qualitative solutions are suggested and priorities based upon the apparent urgency of the problem are offered. The recommendations presented are based upon reconnaissance scope investigations, discussions with local residents, officials and other available information.

THE REPORT

The report itself first presents a broad overview of the entire study area followed by a more detailed inventory of specific problem areas.

The purpose of the general overview is to familiarize the reader with the study area by presenting background information pertaining to the environment, climatology, and the human and economic resources of the area. The remainder of the report deals specifically with each watershed in detail; problem areas are identified, labeled and qualitative solutions are presented for planning purposes.

THE STUDY AREA

ENVIRONMENTAL SETTING

The Study Area consists of two stream basins, one located in northeastern Vermont and the other in central Vermont. Although separated by some fifty miles, many similarities are present.

Miller Run, a tributary of the Passumpsic River in the Connecticut River Basin is located primarily in the Towns of Lyndonville, Wheelock, and Sheffield, in the northeast corner of Vermont. The basin is located approximately 60 miles east of Burlington, Vermont; 150 miles north of Boston, Massachusetts; and 90 miles southeast of Montreal, Canada.

The drainage area for the basin is 48.5 square miles. Eighteen tributaries to the main stem including ten unnamed tributaries comprise a total length of 52.6 stream miles. Pertinent data on the Miller Run watershed are given in Table 1.

In general, the watershed outlined on Plates 1 and 2 is mostly rural farmland surrounded by forested hills. The main stem flows southeast through a valley on a mildly sloping, meandering course. It is abutted by rolling farmland, often cultivated right up to the streambank. The tributaries drop steeply through the forested hills and their streambeds are usually rocky with deep cut banks which are quite stable. Most streams enter the main stem at nearly right angles, which coupled with the fact that most subsoil is sand with gravel, results in extensive erosion and stream meander along the main stem of Miller Run.

The area is habitat for a large variety of wildlife. Wild fowl, including pheasants, quail, and Canadian geese, enjoy the forage areas between the farmland and the forests. The wooded areas are reported to be habitat for bears, deer and other smaller animals indigenous to the area.

The Ayers Brook watershed is located in the center of Vermont in the towns of Randolph, Braintree, Brookfield and Roxbury. The basin is located about 45 miles southeast of Burlington, Vermont; 140 miles northwest of Boston, Massachusetts; and 115 miles south of Montreal, Canada. The brook is a tributary to the Third Branch of the White River in the Connecticut River Basin.

The Ayers Brook watershed, shown on Plate 4 and 5, has a drainage area of 38.3 square miles and is comprised of 12 tributaries to the main brook including 8 unnamed tributaries for a total stream length of 39.9 miles. Table 2 offers a detailed breakdown of the pertinent data for all the tributaries of Ayers Brook.

The terrain along Ayers Brook is quite similar to that of Miller Run. The extremities of the watershed are characterized by steep forested hills. Brookfield Gulf confines the upstream portion of the brook in a narrow, straight pass. After passing through the steep hills the stream slows down and fans out on level ground which is used primarily as agricultural land. Subsoil materials are primarily sand with some gravel. In addition to the erosion of farmland adjacent to the stream, erosion is extensive along high banks near the center of Randolph.

TABLE 1

MILLER RUN - PERTINENT DATA

Stream	Drainage Area (Sq.Mi.)	% of Tot. Area	Stream Length (Mi.)	Total Drop (Ft.)	Avg. Slope	No. of Crossings	Predominant Ground Characteristics
Trib. A	0.20	0.41	0.5	295	11.2	1	70% Clear Land
Trib. B	0.16	0.33	0.6	272	8.60	1	80% Clear Land
Fall Br.	5.41	11.20	5.6	950	3.22	3	50% Clear Land
Trib. C	1.13	2.34	1.9	773	7.71	3	30% Clear Land
Cham-burlain Br.	0.69	1.43	1.0	520	9.85	1	40% Clear Land
Trib. D	6.50	13.5	4.2	1680	7.56	1	10% Clear Land
Square Br.	4.01	8.31	3.6	800	6.33	1	40% Clear Land/5% Marsh
Oregon Br.	3.21	6.64	3.5	502	2.72	0	20% Clear Land/15% Marsh
Trout Br.	2.93	6.07	3.2	675	4.00	6	50% Clear Land
Nation Br.	2.78	5.75	2.8	665	4.50	3	40% Clear Land/5% Marsh
Trib. E	1.94	4.01	2.0	880	8.32	0	20% Clear Land/5% Marsh
Trib. F	0.37	0.77	0.6	308	10.8	0	80% Clear Land
Trib. G	0.97	2.01	1.7	770	8.58	3	50% Clear Land/5% Marsh
Trib. H	1.83	3.79	2.9	925	6.03	1	20% Clear Land/5% Marsh
Mathewson Brook	2.72	5.62	3.0	895	5.42	2	40% Clear Land/20% Marsh
Squabble Br.	2.77	5.74	2.9	680	4.45	1	30% Clear Land/20% Marsh
Trib. I	0.75	1.51	1.6	530	6.28	3	50% Clear Land
Trib. J	0.76	1.57	1.6	420	5.00	2	70% Clear Land
Miller Run	9.53*	19.0	9.4	425	0.86	7	70% Clear Land
TOTAL	48.46	100.0	52.6	2020+		39	

*Drainage area flowing directly into Miller Run not tributary.
+Maximum vertical differential within basin.

Many species of small animals are found in the basin including ruffed grouse, rabbit, squirrel, raccoon and fox. Beaver, muskrat and mink are also found to some extent. Deer are abundant throughout the basin and occasionally black bears are sighted.

CLIMATOLOGY

The study area has a variable climate characterized by frequent but short periods of heavy precipitation. It lies in the belt of the prevailing westerlies and consequently in the path of cyclonic disturbances that cross the country from west or southwest towards the east or northeast. The winters are moderately severe with subzero temperatures quite common, occurring on the average some 40 times each year. Summers are cool with temperatures averaging 60^{o} to 70^{o} Fahrenheit. The mean annual temperature is 44^{o}. Freezing temperatures can be expected between the latter part of September and early May.

The average annual precipitation over the watershed is approximately 40 inches. The maximum and minimum annual precipitations recorded locally at St. Johnsbury, are 48.64 and 27.15 inches respectively.

Annual snowfall for the study area is about 79 inches. Snow cover on the average reaches a maximum depth in late March or early April with water content normally ranging from 6 to 8 inches. Melting of the snow results in heavy spring runoff, but snowmelt alone seldom produces a damaging flood, but the possibility of sudden thaws combined with heavy rains create a potential icy flood hazard every spring.

The region is also exposed to occasional coastal storms, some of tropical origin, that travel up the Atlantic Coast and move inland over New England. In addition, local thunderstorms can cause serious floods because of the steep terrain and relatively short concentration times for the basins.

HUMAN AND ECONOMIC RESOURCES

The two basins are located in the middle, northeastern section of Vermont, an area sparsely populated and typical of rural Vermont in terms of population industry and economic status.

In general, the residents of Miller Run watershed could be described as settled middle class. Less than 1% of the population was born abroad and Black and Spanish speaking minorities are not found in this area. According to the 1970 census figures, the population of Lyndonville was 1415; Wheelock was 238; and Sheffield was 307; for a total of 1960. Although the census is dated the data is probably

TABLE 2

AYERS BROOK - PERTINENT DATA

Stream	Drainage Area (Sq.Mi.)	% of Tot. Area	Stream Length (Mi.)	Total Drop (Ft.)	Avg. Slope	No. of Crossings	Predominant Ground Characteristics
Trib. A	.53	1.4	1.3	750	10.93	1	95% Clear Land
Trib. B	.72	1.9	1.0	270	5.11	0	80% Clear Land
Mill Br.	4.18	10.9	4.6	900	3.71	2	50% Clear Land
Trib. C	1.84	4.8	2.2	880	7.58	5	60% Clear Land
Trib. D	1.84	4.8	1.6	980	11.60	4	60% Clear Land
Cold Br.	.83	2.2	2.8	1110	7.51	4	30% Clear Land
Open Meadow Brook	7.27	19.0	4.3	1200	5.29	16	40% Clear Land
Trib. E	.29	0.8	0.6	750	23.67	0	30% Clear Land
Trib. F	5.37	14.0	3.6	805	4.24	14	50% Clear Land
Trib. G	1.13	3.0	1.2	640	10.10	4	65% Clear Land
Trib. H	0.97	2.5	1.1	610	10.50	2	70% Clear Land
Adonis Br.	6.53	17.1	5.5	850	2.93	24	70% Clear Land
Ayers Br.	6.79*	17.6	10.1	6.35	1.19	10	50% Clear Land
TOTAL	38.29	100.0	39.9	1690+			

*Drainage area flowing directly into Ayers Brook not tributary.
+Maximum vertical differential within basin.

still fairly accurate. The figures represent a 3-10% decline in population over the previous decade. Of the total population 60% have lived at the same location since the previous census in 1965 and only 10% had relocated from outside the State.

The Miller Run area is somewhat depressed economically. Almost 12% of the families survive on less than poverty level income. The cost of living is not as high as elsewhere and land-owning families augment their income by producing some goods (and produce) themselves. The majority of workers are farmers, followed by professionals and skilled craftsmen. The average number of years of education is 12.1.

Statistics for the Ayers Brook watershed are quite comparable to Miller Run. Black and Spanish speaking minorities comprise less than 1% of the population. The populations for the towns in which Ayers Brook lies were 2115 in Randolph, 606 in Brookfield, and 251 in Braintree for total of 3472. These 1970 census figures represent almost no change in population for Randolph and Brookfield, but a 40% increase in Braintree over the previous census. Migration, though small, is slightly more than for the Miller Run area. Approximately 45% of the population lived in the same location in 1965, while only 14% relocated from outside the State.

The area is slightly more economically depressed than Miller Run with 16% of the work force earning less than poverty level income. The majority of workers are craftsmen, then professionals and farmers are next in order of magnitude. Education is comparable in the two basins with residents completing an average of 12.2 years of school.

IDENTIFICATION AND EVALUATION OF PROBLEM AREAS

MILLER RUN

For the purpose of discussion, Miller Run was divided into four zones as follows:

Zone I (Nation Brook to Chamburlain Brook).

Zone II (Chamburlain Brook to Mathewson Brook).

Zone III (Mathewson Brook to Tributary I).

Zone IV (Tributary I to Passumpsic River).

Zone I

Zone I begins in the town of Sheffield where Nation Brook and Trout Brook join to form Miller Run. Nation Brook (Fig. I-1) crosses under State Route 122 through a corrugated metal arch pipe approximately six feet high. No problems exist in this area. The channel is lined with rock, six to twelve inches in diameter, and the culvert and bridge openings (Fig. I-2 to I-4) appear to be more than adequate.

From here the brook parallels Route 122 for about a mile and is crossed by a footbridge (Fig. I-5) and a wooden bridge. The footbridge is located in a wooded area spotted with an occasional house or barn. Fig. I-6 and I-7 taken looking upstream and downstream from the wooden bridge (Fig. I-8) show a rock lined channel bordered by overhanging trees and brush. The bridge provides access to the sawmill in Fig. I-9.

The stream continues to flow southerly to the State Highway bridge where it crosses under Route 122 and then circles around a single family house (Fig. I-10 to I-12). Minor flooding to livestock holding areas occurs here during flood events but no extensive property damage has been recorded. Miller Run then passes under a wooden bridge (Fig. I-15) and again flows alongside Route 122. Small gravel deposits and larger rock deposits such as those in Fig. I-13 and I-14 frequent this stretch of the brook. They do not however, cause a threat to ice flooding since the deposits are too small to retard the passage of ice flows, In addition, the deposits are too inaccessible to warrant an economical removal operation.

Further downstream Miller Run is crossed by another wooden bridge which provides access to a trailer (Fig. I-16) looking upstream from this bridge, displays a rocky, shallow channel much the same as areas immediately upstream and downstream of the bridge (Fig. I-17). The stream which up to this point had paralleled Route 122, quickly shifts toward the highway (Fig. I-18) and then shifts immediately back into a wooded area (Fig. I-19). Several small gravel deposits are visible from this location but like those upstream they are too small and inaccessible to be removed economically. Some flooding and erosion may occur in this area due to the sharp meander in the stream. Damage however, would be limited to a washout of this section of Route 122.

From here the stream continues to flow through a heavily wooded area approximately 300 feet from Route 122. Square Brook (Fig. I-20) flows rapidly from Ferguson Hill under Route 122, then down into the heavily wooded area (Fig. I-21) where it then joins Miller Run. A

rather larger rock deposit (Fig. I-22) is located here. During the spring the ice flow might collect in this area, damaging the stream and causing flooding of adjacent fields and wooded areas. Flood damage as a result of such an occurrence would be minor since the deposit is in an undeveloped area about 1,500 feet from Route 122. Other smaller rock deposits frequent the stretch of Miller Run between Square Brook and the old white church in Sheffield. Access to these areas is also difficult.

Emerging from the woods, the brook returns to Route 122 (Fig. I-23) where it parallels the highway behind a row of houses in Sheffield for a quarter of a mile, then turns and crosses under the highway. Fig. I-25 taken from the bridge looking upstream shows a rocky channel dotted with a few fallen branches and miscellaneous debris. Looking downstream from the bridge (Fig. I-25) the channel begins to widen. The bridge opening (Fig. I-26) seems adequately large enough to handle rather large discharges.

Miller Run, continues southerly for about 500 feet where it is then joined by Tributary D. Looking upstream from a privately owned wooden bridge, rather large gravel deposits (Fig. I-27) mark the confluence. Should ice flows jam in this area several homes in Sheffield center may experience some flooding. This area is easily accessible and is a potential harvest area. Looking downstream, rock outcrops and several small gravel deposits are visible (Fig. I-28). Access to these deposits would be difficult but since they do not present a flood hazard, it is not necessary that they be removed.

Zone II

Zone II begins where Chamburlain Brook joins Miller Run. The stream flows southerly under a wooden bridge (Fig. II-1) and continues downstream (Fig. II-2 to Fig. II-4) to where a single family dwelling abuts the stream. The owner stated that he has not experienced any flooding in the past five years he has lived there. In this reach, the channel bottom is comprised of ledge.

Miller Run continues for about 1,500 feet to its confluence with Tributary G (Fig. II-5 and Fig.II-6). Here the channel widens again (Fig. II-7) as the stream leaves the heavily wooded areas and enters the low flat pasture lands bordered by trees and heavy brush. From this point to the Sheffield-Wheelock town line many gravel and sand deposits (Fig. II-8 to Fig. II-15) are located on the inside of all bends in the stream. The deposits are quite extensive. The many meanders in the stream have created an excellent location for a removal operation. Access to this area would be through the farmlands shown in Fig. II-16. Although the many deposits are a potential ice flooding hazard, no extensive flood damage would result from such an event.

From the Sheffield-Wheelock town line to the end of Zone II, several small sand and gravel deposits are located on the inside of all bends in Miller Run (Fig. II-17). Rock outcrops (Fig. II-18 to II-20) are found in this stretch with fallen trees and debris sometimes found along the banks. After its descent down the steep ledge fall shown in Fig. II-19, the gradient flattens and the stream crosses Route 122 twice through Wheelock then follows alongside the highway. No problems were observed in this area.

Zone III

Zone III begins where Mathewson Brook joins the main stem of Miller Run. Throughout most of this zone Miller Run follows closely the course of Route 122. Small deposits such as those in Fig. III-1 to Fig. III-3 are found along this entire stretch of river. Although access to these areas is easy the small quantities at each location would not sufficiently offset the removal costs and since they do not present any flood threat they need not be removed. Fallen trees such as the one in Fig. III-4 are also found in this zone. During flood events they would present a major hydraulic restriction resulting in flooding of Route 122 and the surrounding area.

Further downstream the stream flows adjacent to farmlands causing some minor bank erosion and depositing sand and gravel on the inside of most bends. One major erosion and sedimentation problem exists along this stretch and is shown in Fig. III-5 to III-7. Another is shown in Fig. III-8.

Zone IV

Zone IV begins where Tributary I joins Miller Run. About a half mile downstream the brook flows under a recently constructed bridge (Fig. IV-1) located on a back road to Lyndon Center. Downstream of the bridge sand and gravel deposits as well as dead trees and debris are located along the right bank (Fig. IV-2).

The brook then flows through a row of trees and heavy brush which border the flat open fields adjacent to Route 122. Continuing downstream the stream momentarily parallels Route 122 at its intersection with Interstate Route I-91 (Fig. IV-3) then turns and heads out around the open fields. From this point to the covered bridge on Route 122, the stream meanders depositing sand and gravel on the inside of bends eroding farmland on the outside of bends. Access to these areas for a removal operation is fairly easy but only small amounts of material can be found at each location. No serious flood problems exist in this area.

Downstream of the covered bridge a large tree has been undermined and is now arched over the brook. This tree should be removed because during high flows it acts as a dam retarding flows and causing flooding. Miller Run continues through a wooded area for about 1,500 feet to its confluence with the Passumpsic River. Large sand deposits mark this confluence (Fig. IV-4). Access to the confluence is fairly easy either through the fields at the right of Fig. IV-4 or by a private roadway which intersects Route 122 just south of the covered bridge.

AYERS BROOK

For the purpose of discussion, Ayers Brook was divided into four zones as follows:

Zone I (Brookfield Gulf to Open Meadow Brook).

Zone II (Open Meadow Brook to Tributary G).

Zone III (Tributary G to Triburary B).

Zone IV (Tributary B to the Third Branch White River).

Zone I

Zone I of Ayers Brook begins in Brookfield Gulf and ends at its confluence with Open Meadow Brook. In the upper reaches of Zone I the brook is quite small, often hidden amongst the tall ferns and heavy brush. The brook follows closely the course of State Route 12 with the base of the roadway embankment forming one side of its channel (Fig. I-1 to I-8). During high flows, the gravel material along the shoulder of the road often washes away and frequent repair work is required by the State of Vermont (Fig. I-3, I-8, and I-15). The brook crosses Route 12 several times along the Allis State Forest Park. Two of these crossings are shown in Fig. I-9 and I-10.

Downstream of the culvert shown in Fig. I-10 the stream gradient flattens out, decreasing velocities and causing the deposition of a large quantity of gravel (Fig. I-11). The deposits have caused the brook to cut a new channel through the pine trees (Fig. I-12 and I-13). There is a large quantity of gravel available at this location and since access to the area is possible, a removal operation might be considered. Further downstream a wooden bridge (Fig. I-14) crosses the brook. Clearance beneath the deck is minimal causing branches and debris to get hung up on its upstream face. This bridge should be either removed or replaced.

Ayers Brook continues downstream bordered by trees on the right and the roadway embankment on the left (Fig. I-16). Small washouts like that in Fig. I-15 frequent this stretch of Route 12. At the downstream end of Brookfield Gulf, Ayers Brook flows through an open field where some bank erosion has developed during high flows (Fig. I-17). The erosion is minor but the gravel deposits are of significance and may be considered for harvesting. After passing through the field, the brook crosses under Route 12 through the culvert pictured in Fig. I-18. This culvert which was numbered 51/12 is in need of repair as is evidenced by the exposed reinforcement bars. Although some flooding does occur in this zone, the resulting flood damage would be minimal.

Zone II

Zone II of Ayers Brook begins at the confluence of Open Meadow Brook and ends where Tributary G joins Ayers Brook. Looking upstream at Open Meadow Brook (Fig. II-1), the brook crosses Route 12 and flows for approximately 1,000 feet to its confluence with Ayers Brook. The bridge, 50/12, is structurally sound, but the concrete decking is in need of repair.

Just downstream of the confluence with Open Meadow Brook, Cold Brook descends from Mt. Nevins, crosses Route 12, and joins Ayers Brook. The brook then flows southerly to an unpaved road which intersects the brook in an undeveloped area about 1500 feet from Route 12. Upstream of this crossing (Fig. II-2), fallen trees and small gravel deposits are found on the inside of all bends. Downstream of the bridge (Fig. II-3) the stream gradient increases and except for a few fallen trees, the channel is relatively clear. The bridge, constructed of stone with a wooden decking (Fig. II-4) appeared to be unstable.

Continuing downstream, the brook flows adjacent to several farms to East Braintree where it is then joined by Tributary D. Tributary D flows down from Pumpkin Rim (Fig. II-5), crosses under Route 12 (Fig. II-6), and continues some 300 feet to its confluence with Ayers Brook. In this final stretch, bank erosion has occurred (Fig. II-7 and II-8). An old footbridge (Fig. II-9) has been undermined and its remains are located in the stream.

After its confluence with Tributary D, Ayers Brook continues southward flowing through the corrugated metal arch pipe (Fig. II-10 and II-11) under Route 12. No problems were observed in this area or immediately downstream of the bridge (Fig. II-12). However, about 1000 feet downstream of the bridge, Ayers Brook has begun to shift its

course, falling trees, leaving sand and gravel deposits and eroding portions of the bank, (Fig. II-13 and II-14). No problems exist along Tributary F either upstream (Fig. II-16) or downstream (Fig. II-15) of the Route 12 bridge but just downstream of its confluence with Ayers Brook a significant change is underway. An old oxbow in the brook has been cut off (Fig. II-17 to II-19) leaving behind a sand and gravel deposit approximately 125 feet long x 100 feet wide x 2 feet deep in size. Trees have been undercut and banks eroded and the brook has begun to cut a new channel through the adjacent farmlands. This is an excellent harvesting location with access possible through the open field adjacent to the cemetery, located near Route 12. Flooding in this area is limited to the inundation of the neighboring fields. Smaller problem areas exist downstream of this point as is evidenced by the gravel bar downstream of the wooden bridge at Howard Hill Road, Fig. II-20. Just downstream of this bridge, Tributary G crosses Route 12 and joins Ayers Brook.

Zone III

Zone III begins at Tributary G and ends at the confluence of Tributary B with Ayers Brook. In Zone III, the brook follows closely the course of Route 12, occasionally drifting away from the roadway.

The most severe problem area in this zone is located where Tributary G enters Ayers Brook. Here an extremely bad erosion problem has developed (Fig. III-1), sand deposits of sufficient size to harvest have resulted and many trees have fallen or are leaning toward the river (Fig. III-2 to III-4).

Fig. III-5 to III-12 are characteristic of the entire reach of Zone III. Deposits such as those in Fig. III-8 are found on the inside of all bends, while bank erosion like that in Fig. III-6 is found on the outside of most bends. Trees have fallen in the river (Fig. III-7) while others which arch the channel will soon be undermined and will choke the flow, causing major obstruction (Fig. III-12). The deposits in this zone are fairly widespread and probably would not be worthwhile removing. The trees, however, should be removed for they could present a major restriction to ice flows.

Zone IV

Zone IV begins at Tributary B and ends at the confluence of Ayers Brook and the Third Branch White River. Just as in the previous zones, small deposits are found on the inside of bends and erosion on the outside banks but they do not cause any serious flooding problems. The principal problem area, however, is located at the site of a defunct motel in the Town of Randolph. The motel once stood on a (40 x 50' high sandbank. Since 1962, the stream has cut into the bank approximately 100 feet. The motel was comprised of one four unit building and three single cabins. Over the years erosion has crept so far that the multi-unit had to be demolished in 1973 to prevent it from going over the bank. Now the cabins are endangered. The State of Vermont has constructed a new bridge at Route 12 (Fig. IV-3 and IV-4). The culvert (about 12'

x 25') is sufficient in size and the approach channel has been adequately protected with stone riprap. The areas upstream, however, are still vulnerable to bank erosion and if remedial action is not taken soon, the remaining cabins will slide down the embankment into the brook.

About 500 feet upstream of the motel a similar erosion problem exists (Fig. IV-1 and IV-2). At the direction of the Soil Conservation Service, larger trees have been cut down to eliminate bank weight, thereby relieving stresses in the soil. The stumps and roots, however, have been left in a vain attempt to stabilize the bank. This area also requires immediate attention.

Downstream of the new bridge (Fig. IV-5) there is stone protection on either side of the brook for a distance of 150 feet. Continuing downstream, small deposits of gravel are located at bends with only one rather large one just downstream of the Route 66 bridge (Fig. IV-7) being of potential harvest value. No significant problem areas were found in this area.

SUMMARY

This report presents the results of our study of the water resources problems in the Miller Run and Ayers Brook watersheds by first presenting a broad overview of the entire study area, followed by a more detailed inventory of specific problem areas. The study area was discussed in reference to its environmental setting, climatology and human and economic resources.

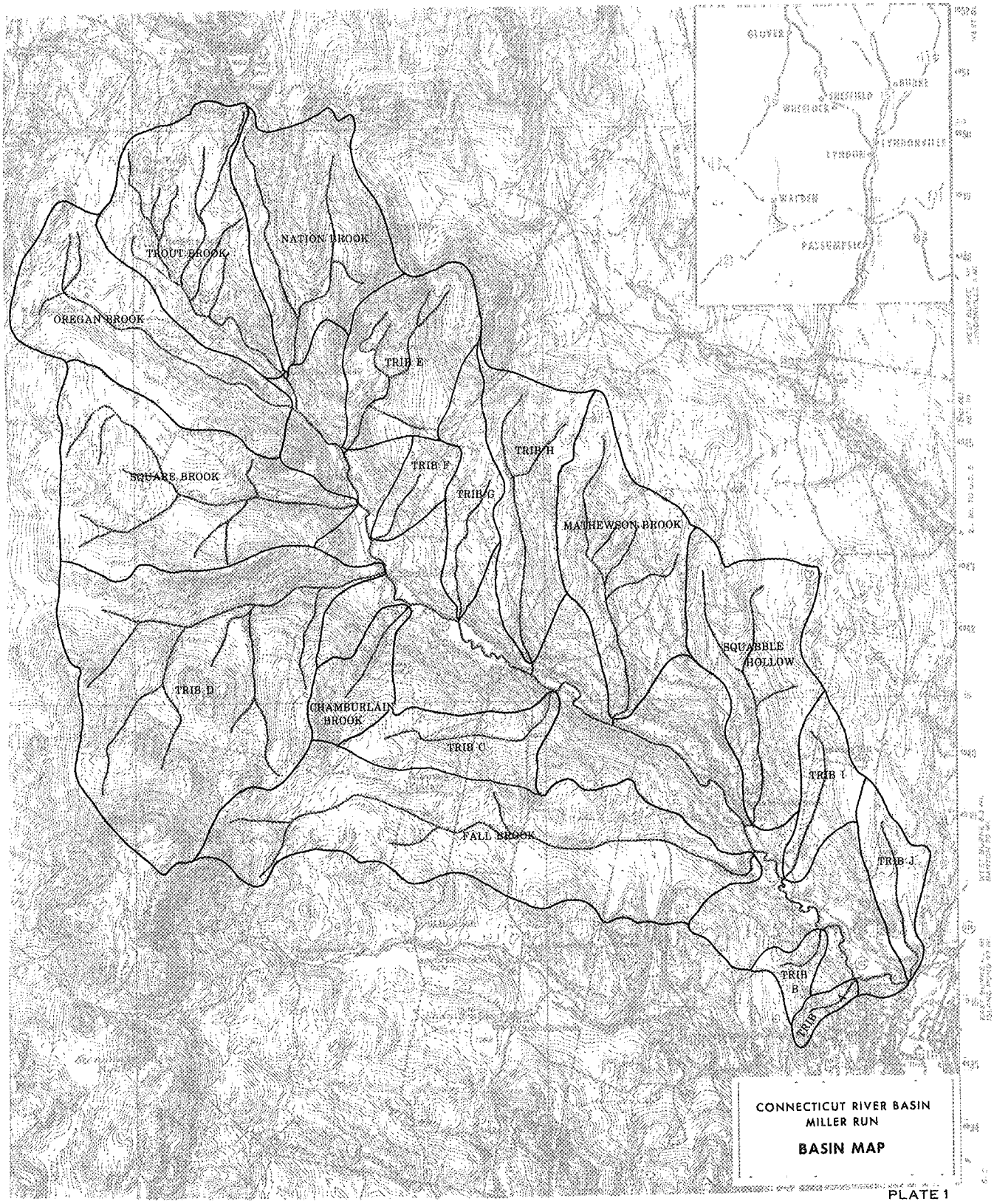
The detailed inventory consisted of identifying all water resources problems in the study area. Problems of bank erosion, sand and gravel depositions, fallen trees and miscellaneious debris exist along the entire reach of both Miller Run and Ayers Brook. The severity of the problems were noted and their locations cited so that the necessary remedial measures could be accomplished by the State of Vermont when resources are made available. Because it is neither practical nor economically feasible to remove all deposits and snags and repair all areas of bank erosion, emphasis should be placed on the most severe problem areas in both watersheds.

CONCLUSIONS AND RECOMMENDATIONS

Throughout the entire lengths of Miller Run and Ayers Brook gravel deposits as well as sand deposits are found on the inside of most bends in areas where stream velocities decrease because the gradient flattens out. Most of these deposits are small but the larger ones present a flood hazard because ice tends to hang up on such deposits creating a chain effect upstream and a potential ice jam. It is recommended that the larger deposits in areas where flood damage would be extensive be removed first and that other larger deposits in less critical areas be removed only if their harvest value makes such a venture worthwhile.

The fallen trees and debris which have collected in various locations along both streams should be removed because they create an obstruction to flow and a potential hangup location for ice. In addition, trees which lean over the brook but are still rooted are also a potential obstruction and should be removed if resources permit.

Finally bank erosion exists in varying degrees along Miller Run and Ayers Brook. Minor areas of erosion are plentiful and would require unlimited resources to correct. Emphasis should be placed on stabilizing the major areas of erosion. Stone slope protection, soil retention blankets, gabions, and vegetation are some of the most common remedial measures taken to stabilize areas of bank erosion. If possible these methods should be used in areas where the land lost is of significant value. In cases of extreme erosion such as that in the area of the motel near Ayers Brook, the embankment is too high and slope too steep to employ ordinary corrective measures. It is suggested that the slopes in this area be cut back to a 3 on 1 slope. The slope should then be seeded to help prevent future erosion.



CONNECTICUT RIVER BASIN
MILLER RUN

BASIN MAP

PLATE 1

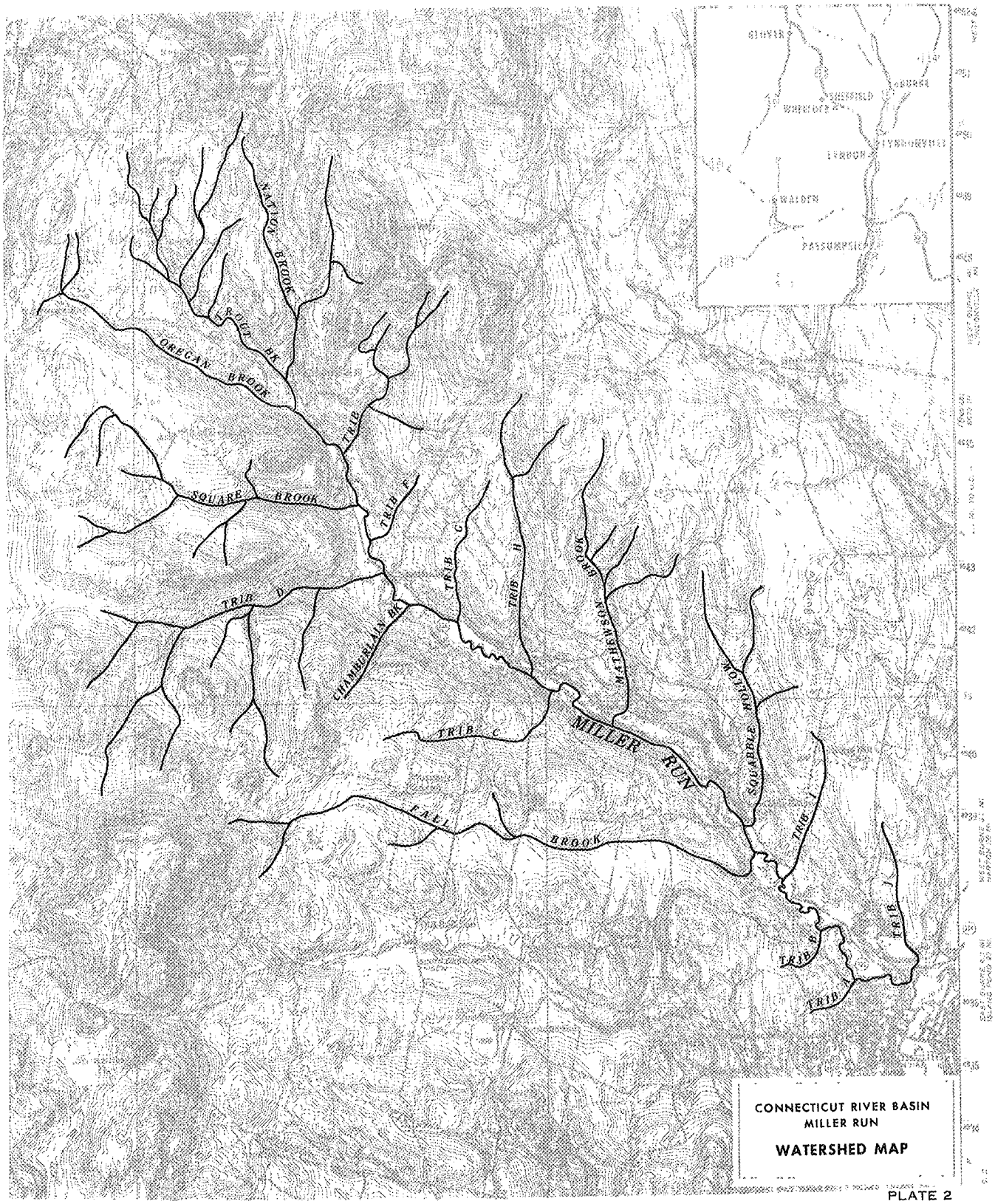

NATION BROOK
LA POUT BK
OREGAN BROOK
TRIB
SQUARE BROOK
TRIB E
TRIB D
CHAMBERLAIN BK
TRIB G
TRIB H
TRIB C
MILLER RUN
MOLTON
SQUABBLE
TRIB I
TRIB J
TRIB B
TRIB A
FALL BROOK
CONNECTICUT RIVER BASIN
MILLER RUN
WATERSHED MAP

PLATE 2

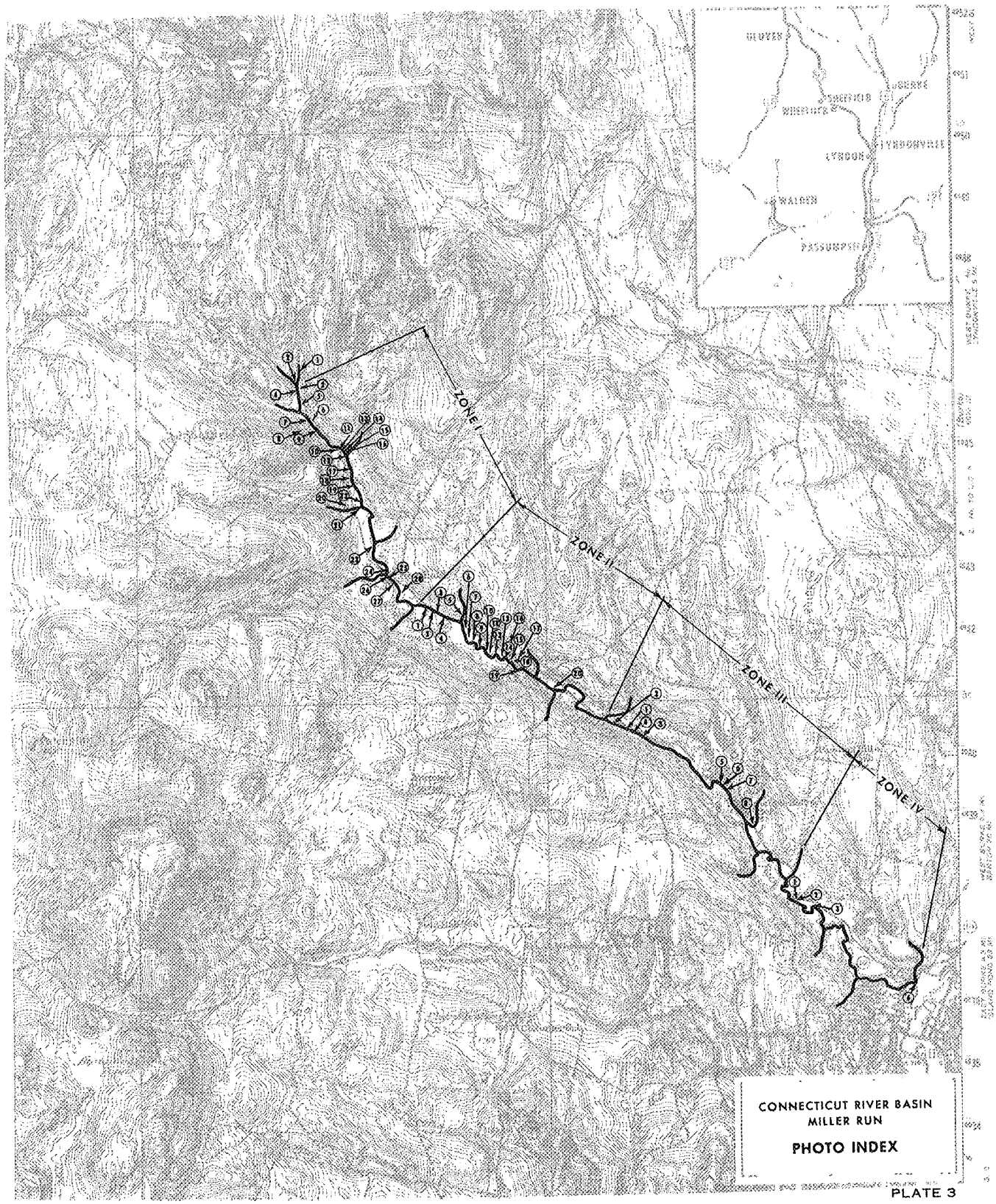
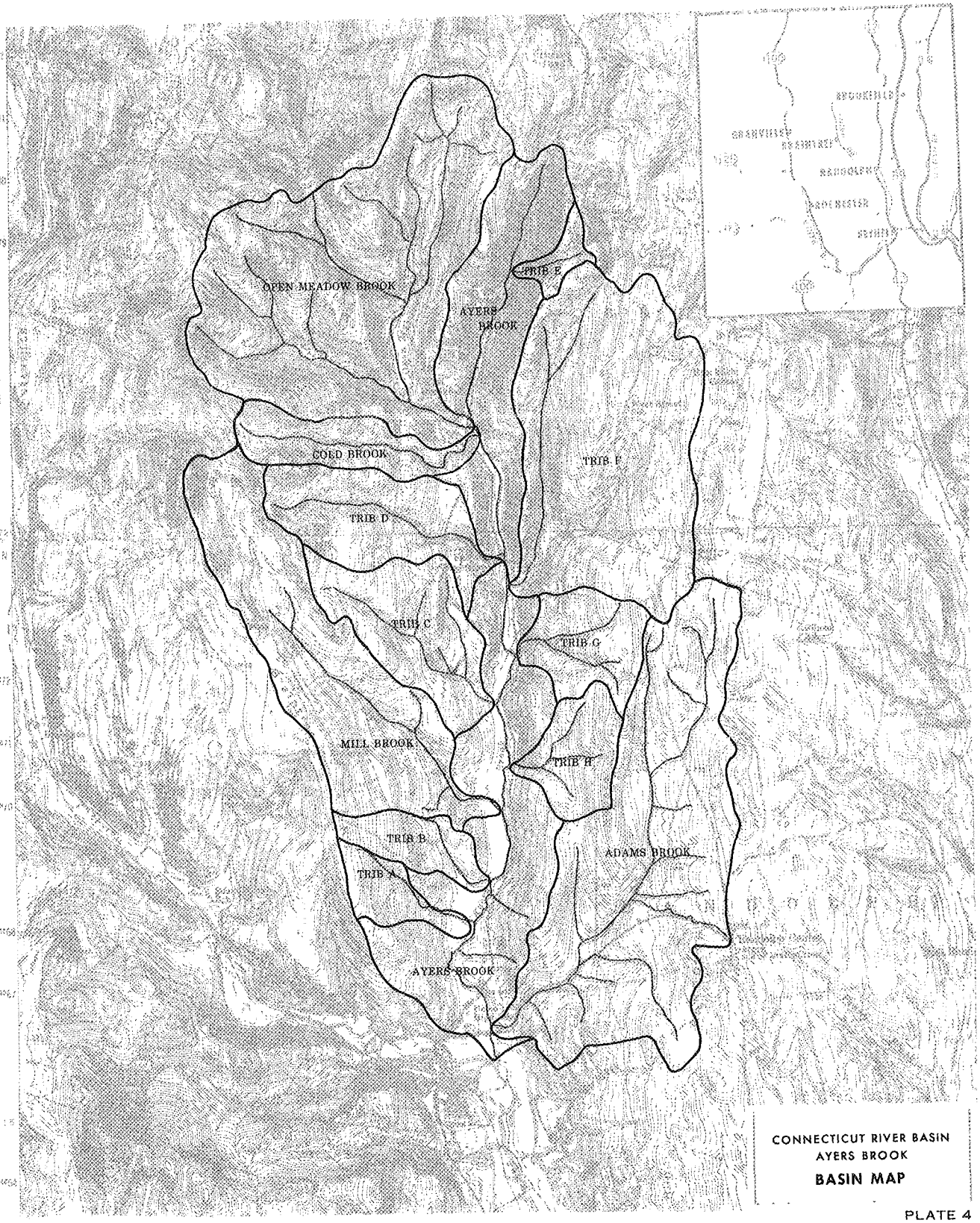

ZONE I
ZONE II
ZONE III
ZONE IV
CONNECTICUT RIVER BASIN
MILLER RUN
PHOTO INDEX

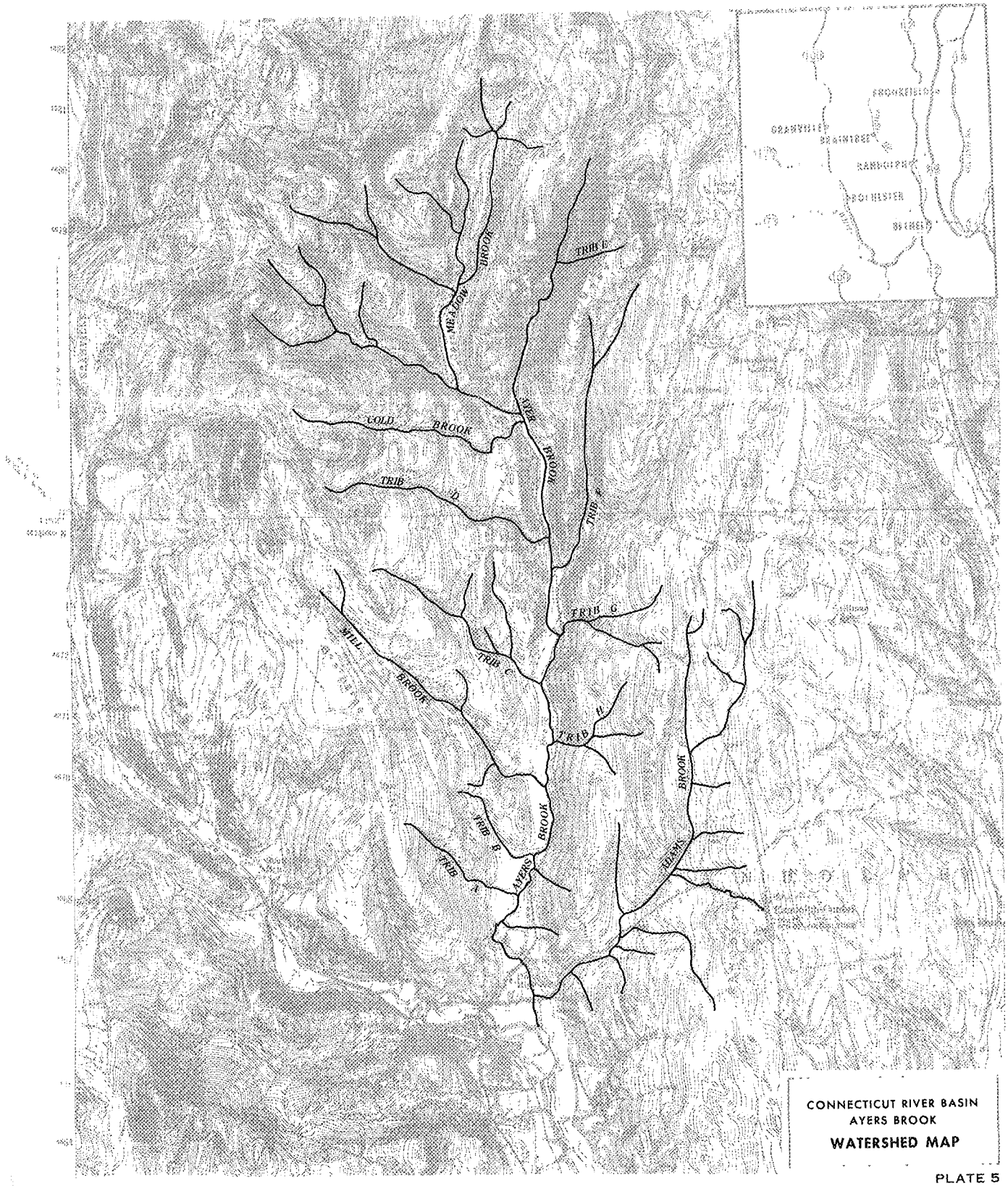
PLATE 3



CONNECTICUT RIVER BASIN
AYERS BROOK

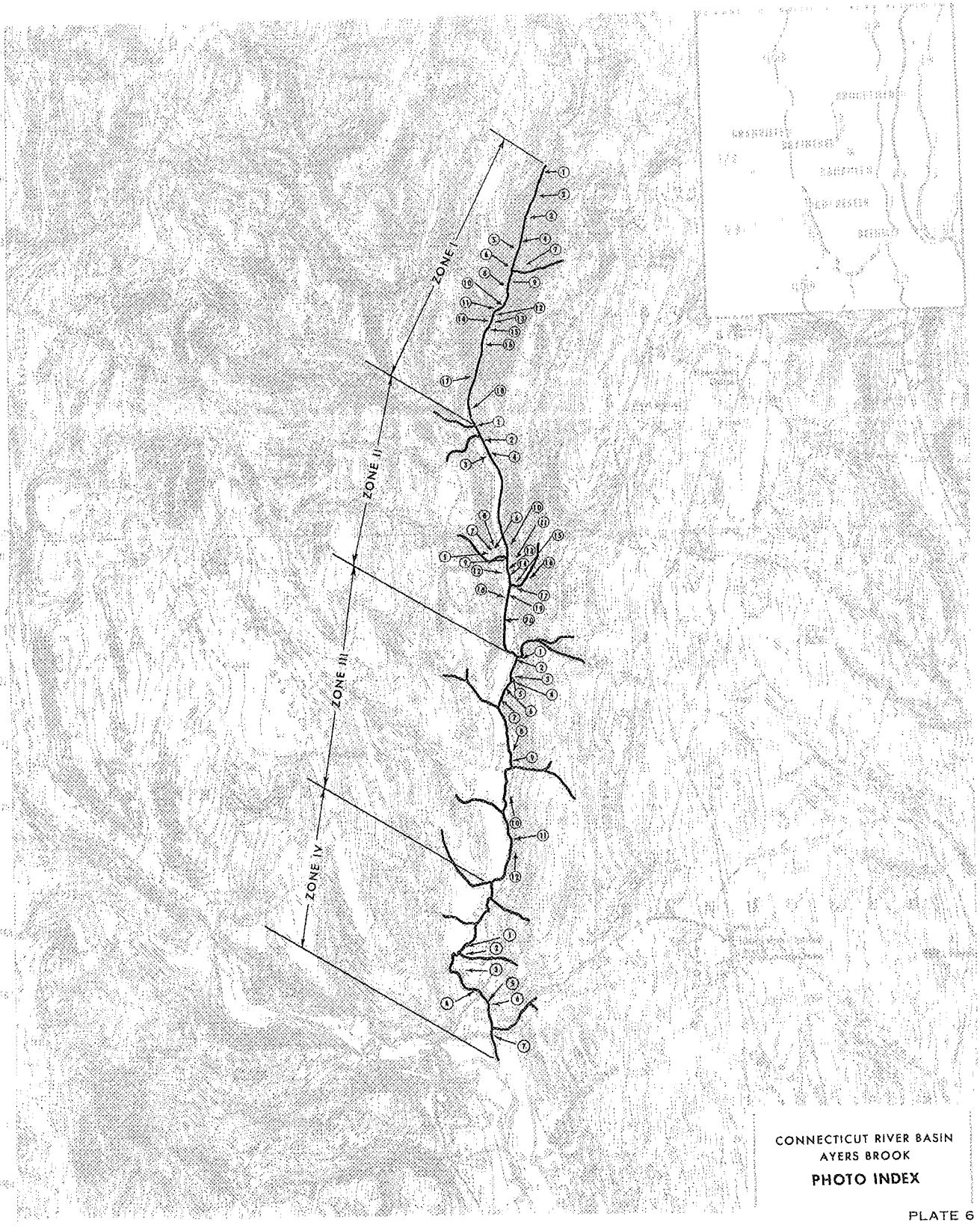
BASIN MAP

PLATE 4



CONNECTICUT RIVER BASIN
AYERS BROOK
WATERSHED MAP

PLATE 5



CONNECTICUT RIVER BASIN
AYERS BROOK

PHOTO INDEX

PLATE 6

APPENDIX I

MILLER RUN - PHOTOS

ZONE I: MILLER RUN (Nation Brook to Chamberlain Brook).

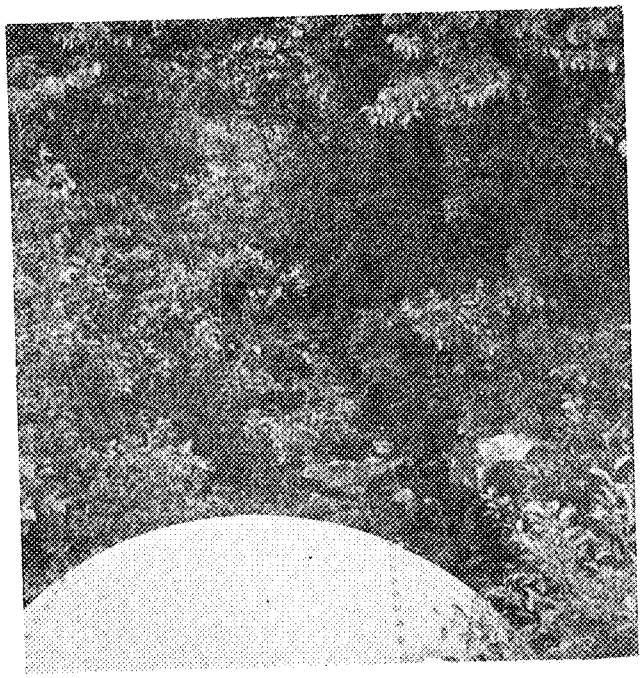


Fig. I - 1

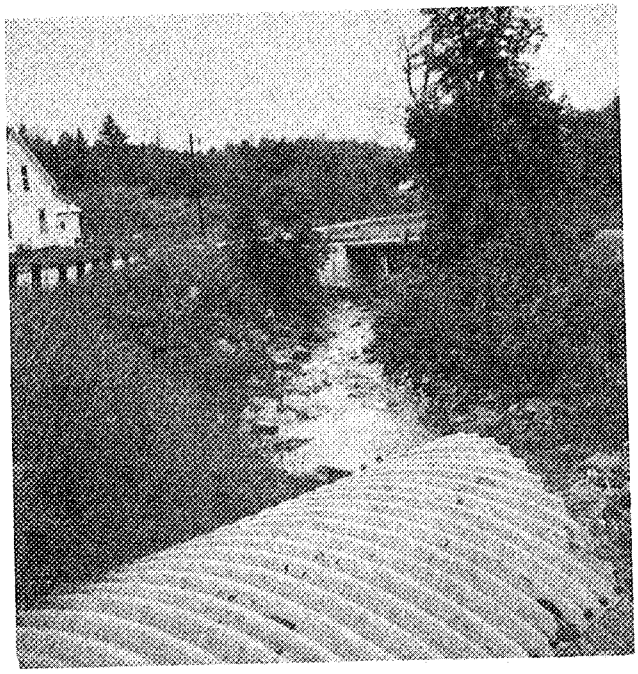


Fig. I - 2

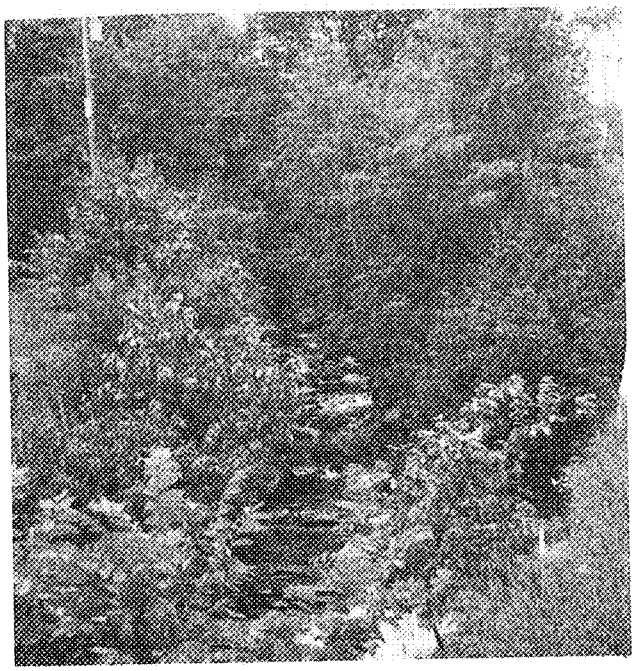


Fig. I - 3

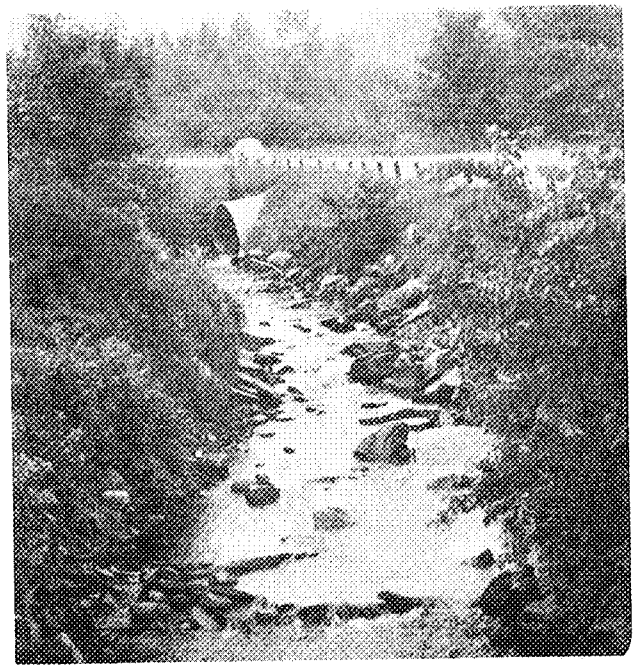


Fig. I - 4

ZONE I: MILLER RUN (Nation Brook to Chamburlain Brook).

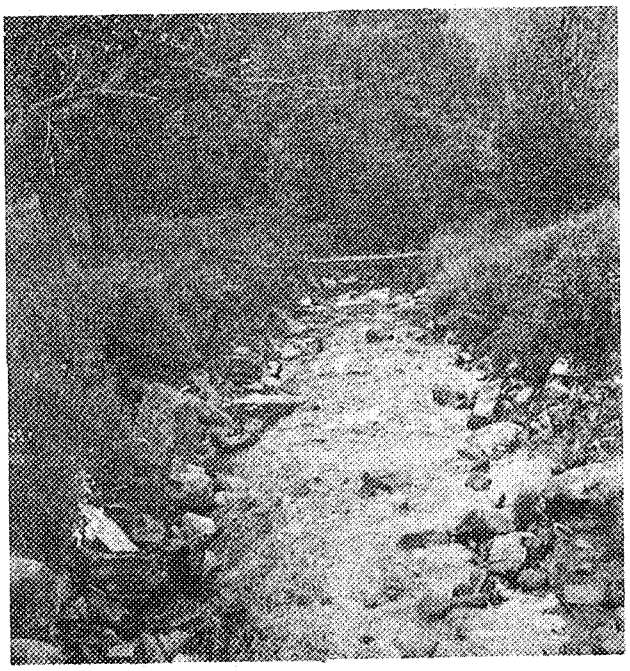


Fig. I - 5

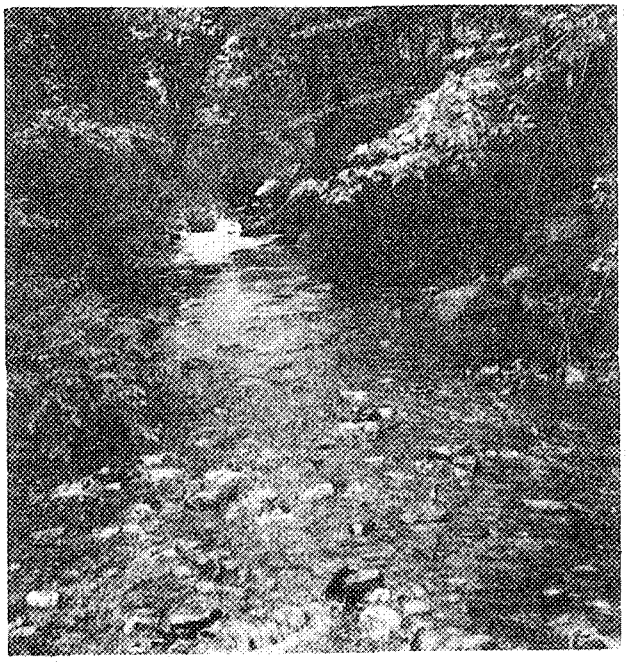


Fig. I - 6

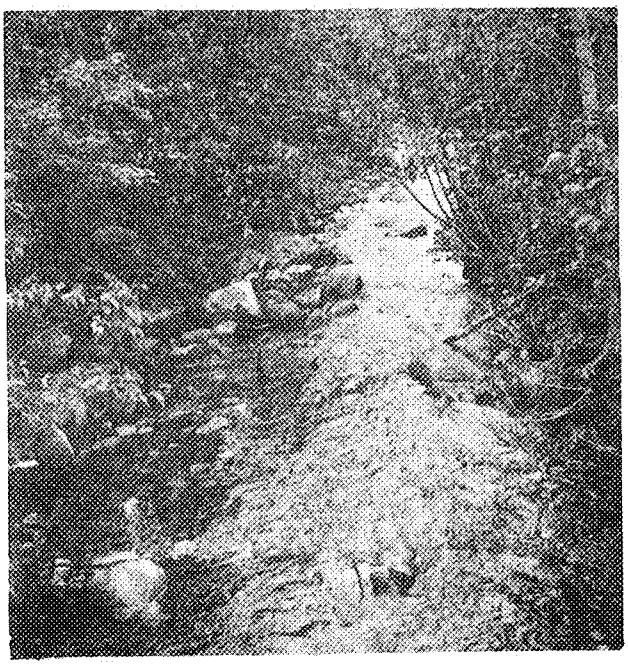


Fig. I - 7

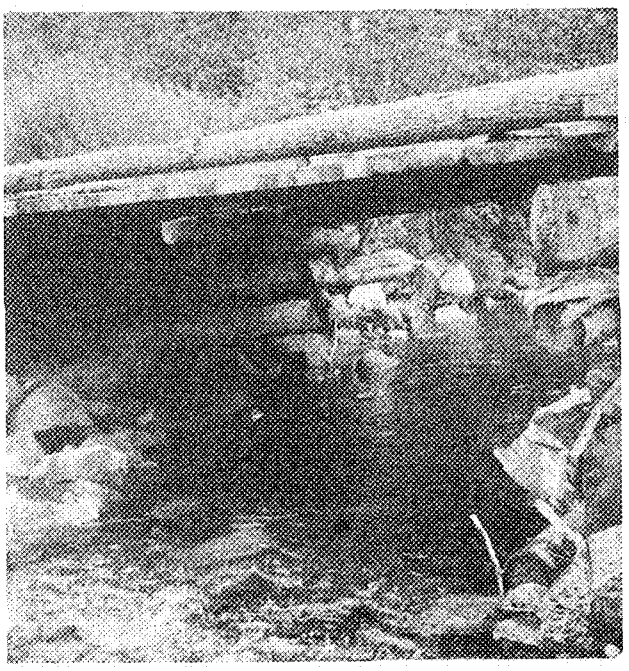


Fig. I - 8

ZONE I: MILLER RUN (Nation Brook to Chamburlain Brook).

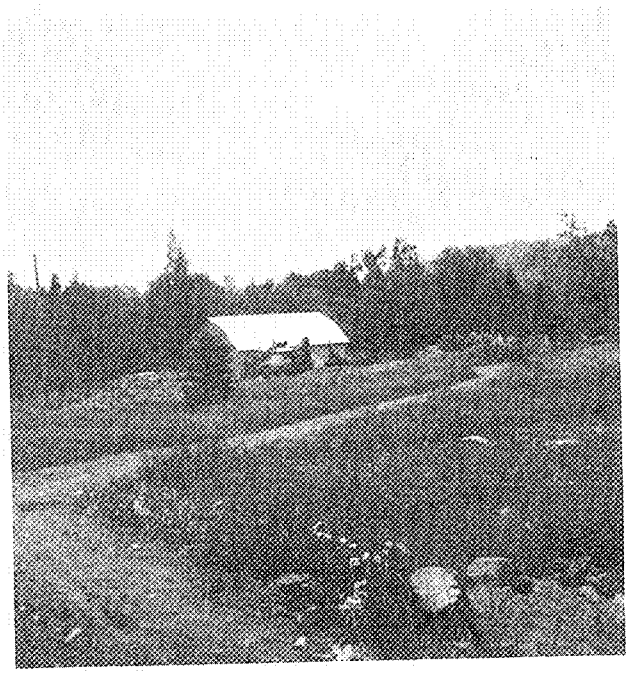


Fig. I - 9

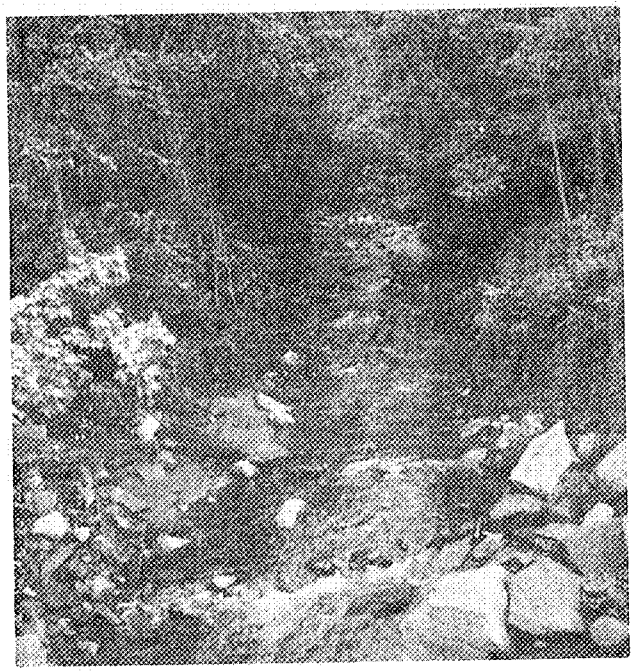


Fig. I - 10

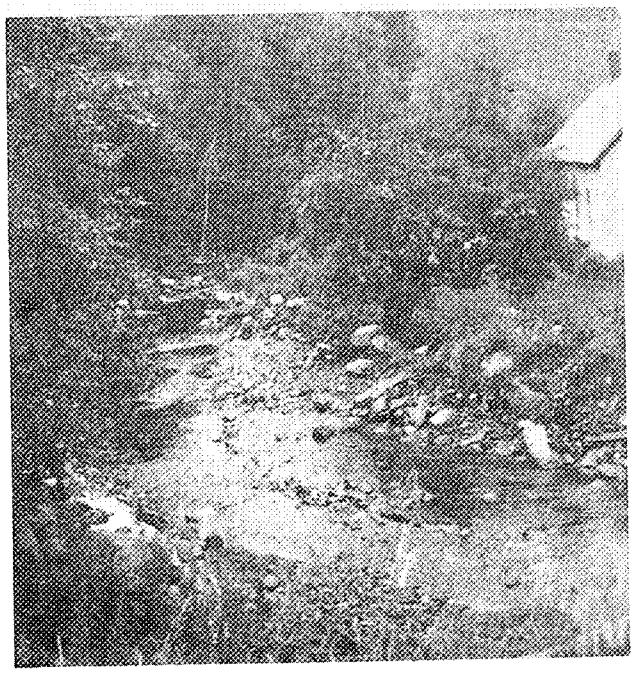


Fig. I - 11

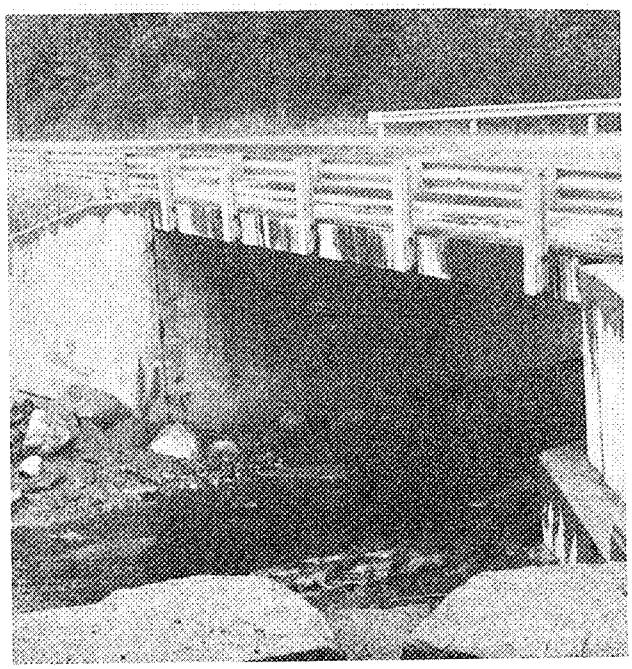


Fig. I - 12

ZONE I: MILLER RUN (Nation Brook to Chamburlain Brook).

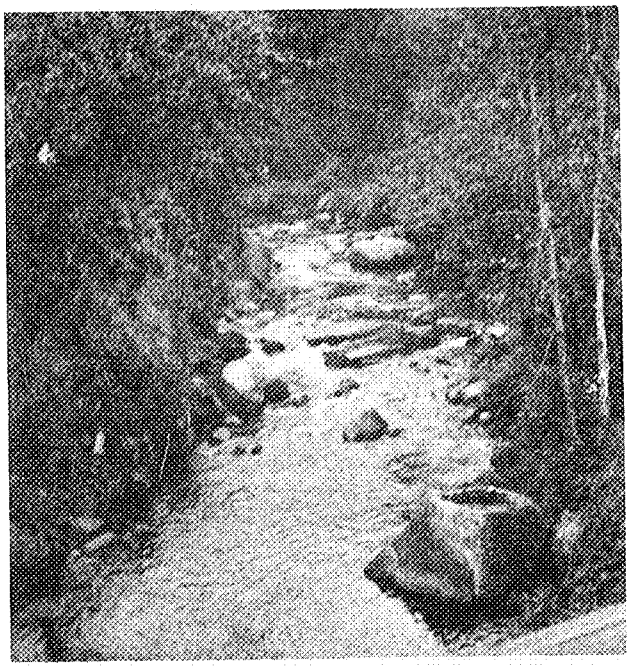


Fig. I - 13

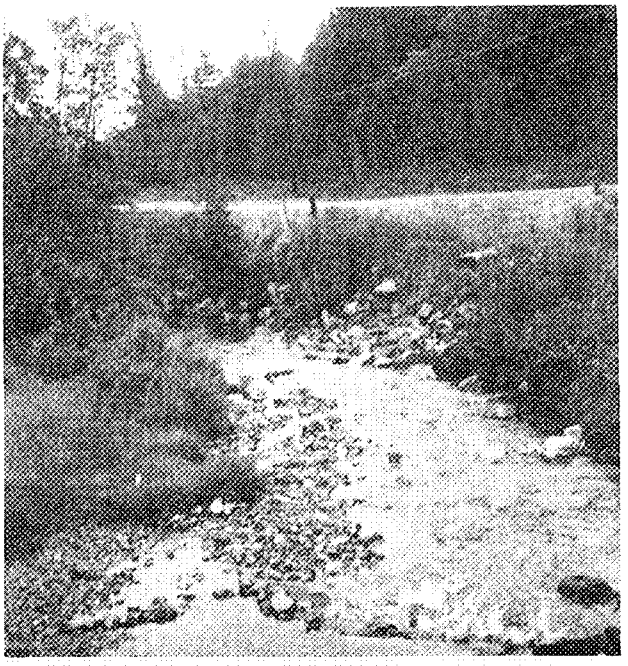


Fig. I - 14

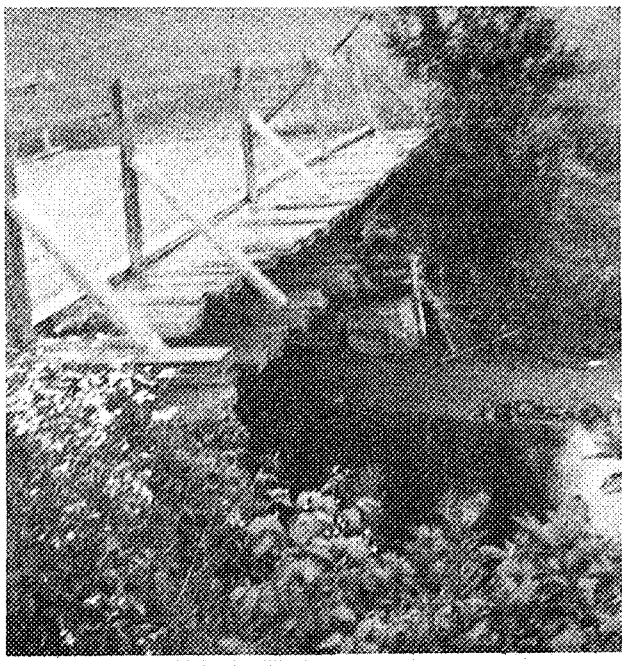


Fig. I - 15

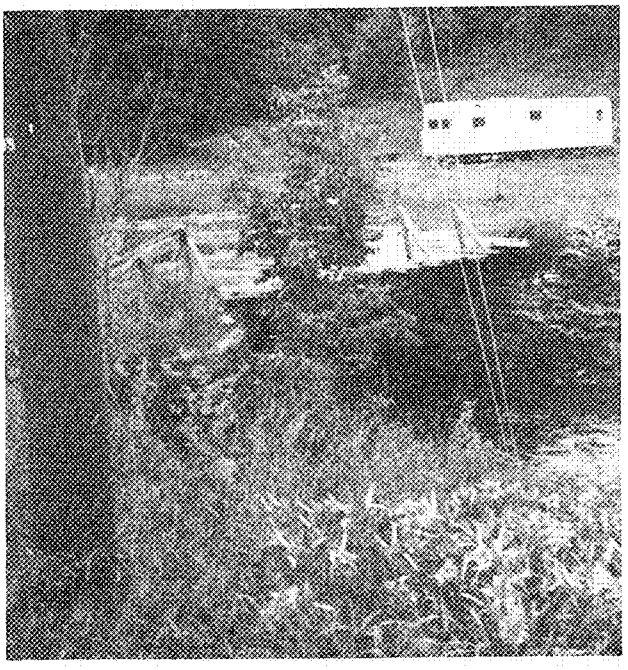


Fig. I - 16

ZONE I: MILLER RUN (Nation Brook to Chamburlain Brook).

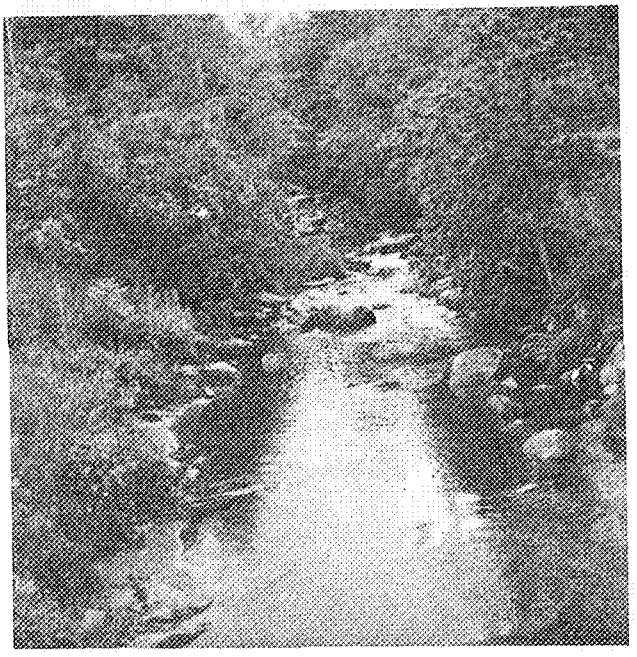


Fig. I - 17

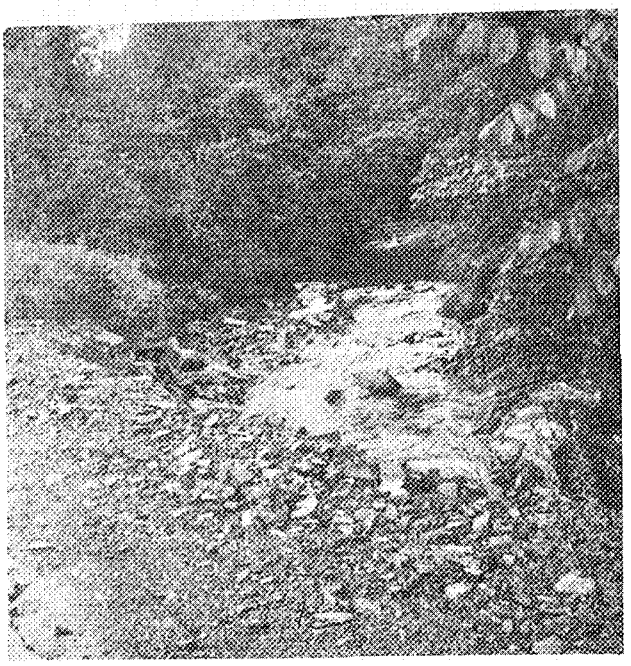


Fig. I - 18

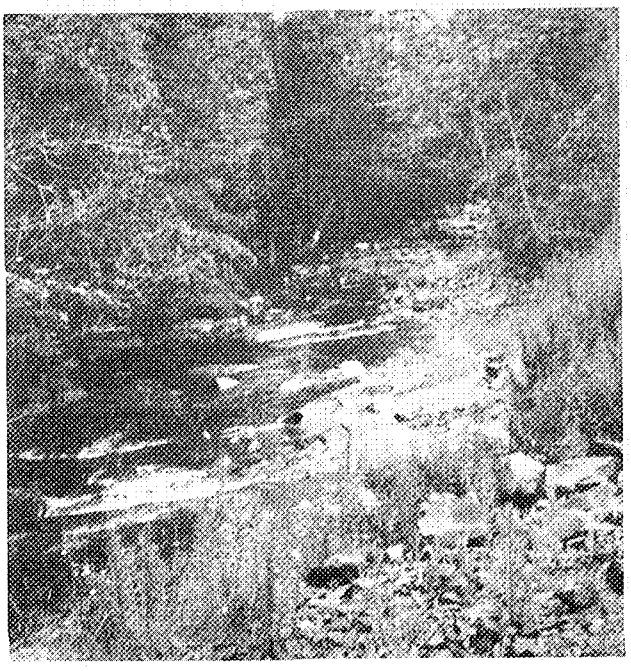


Fig. I - 19

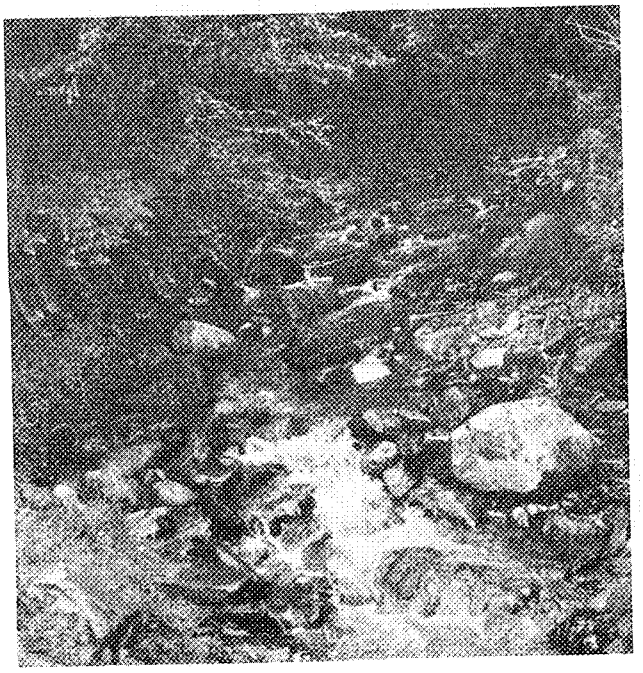


Fig. I - 20

ZONE I: MILLER RUN (Nation Brook to Chamburlain Brook)

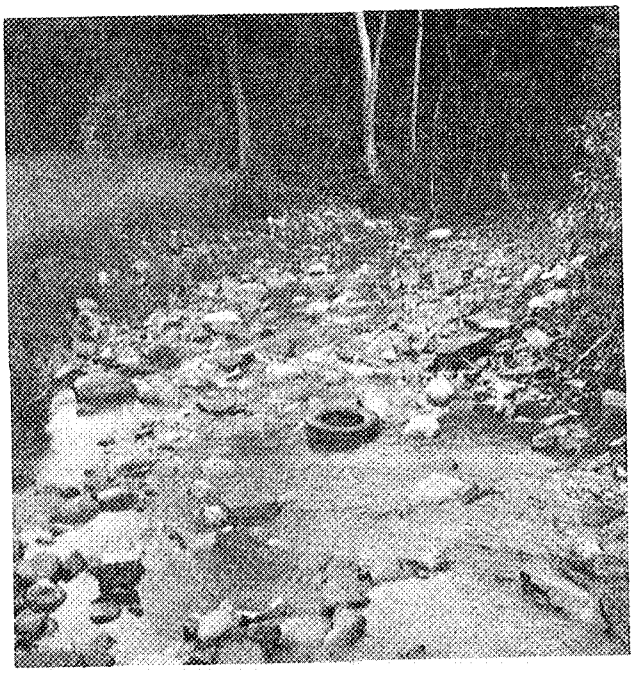


Fig. I - 21

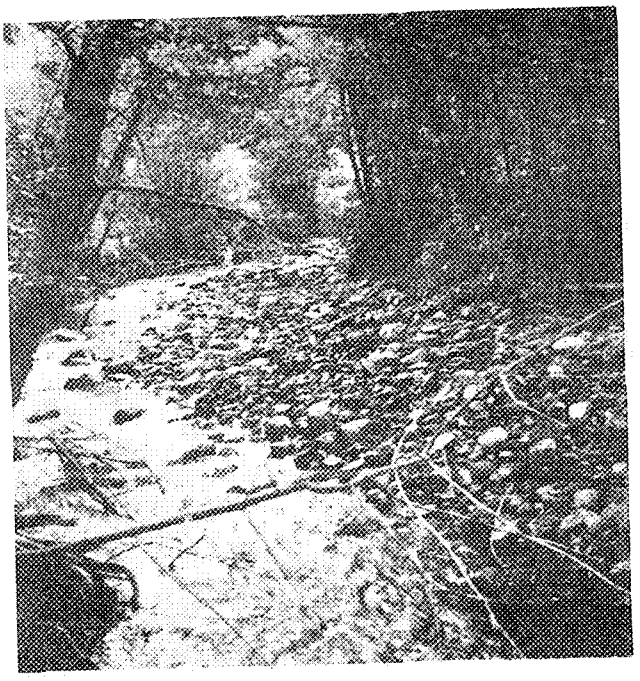


Fig. I - 22

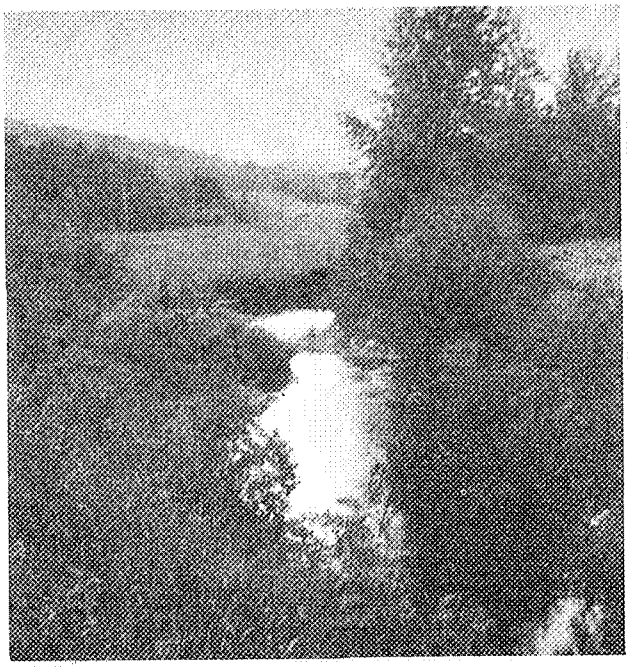


Fig. I - 23

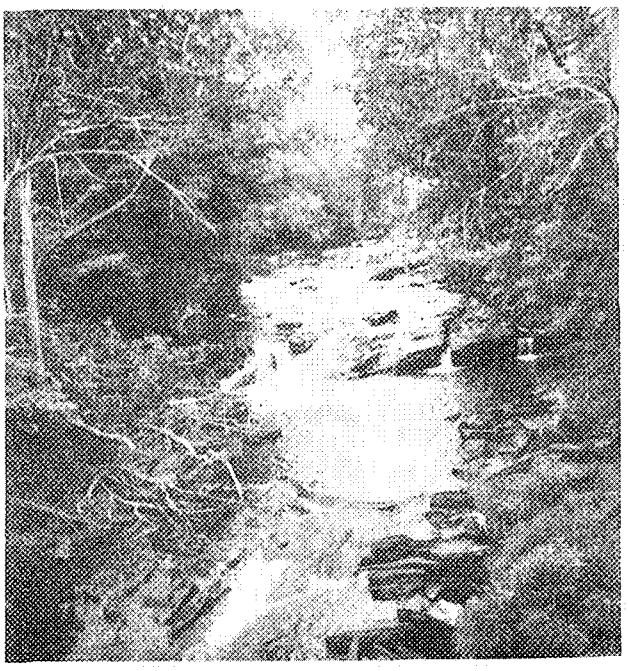


Fig. I - 24

ZONE I: MILLER RUN (Nation Brook to Chamburlain Brook).

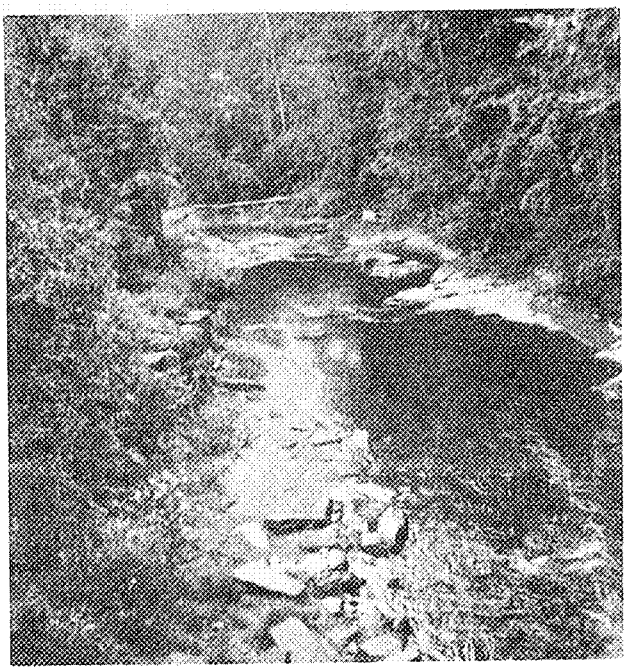


Fig. I - 25

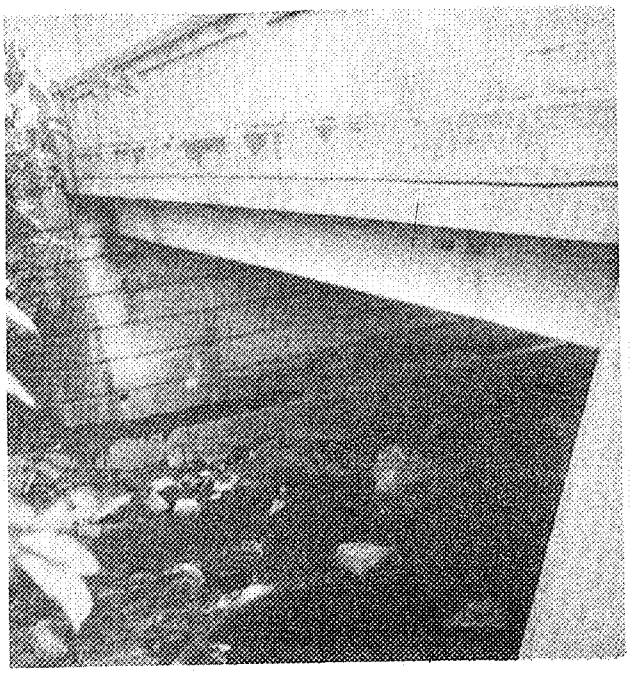


Fig. I - 26

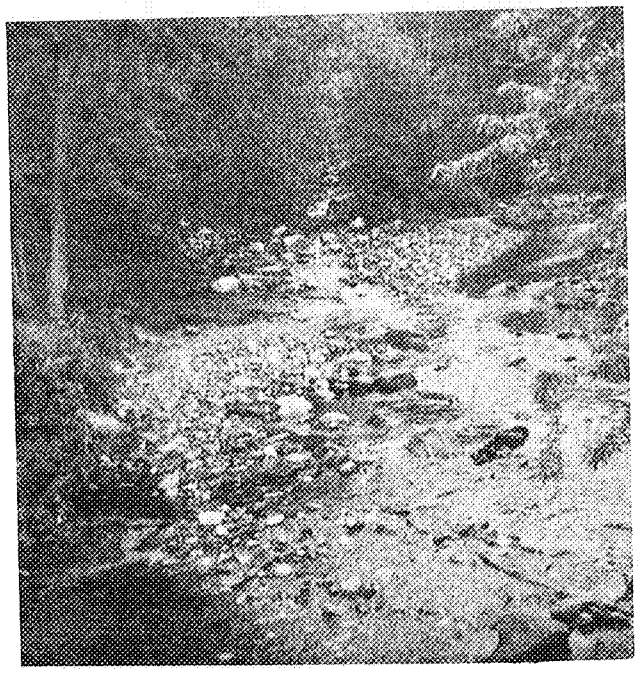


Fig. I - 27

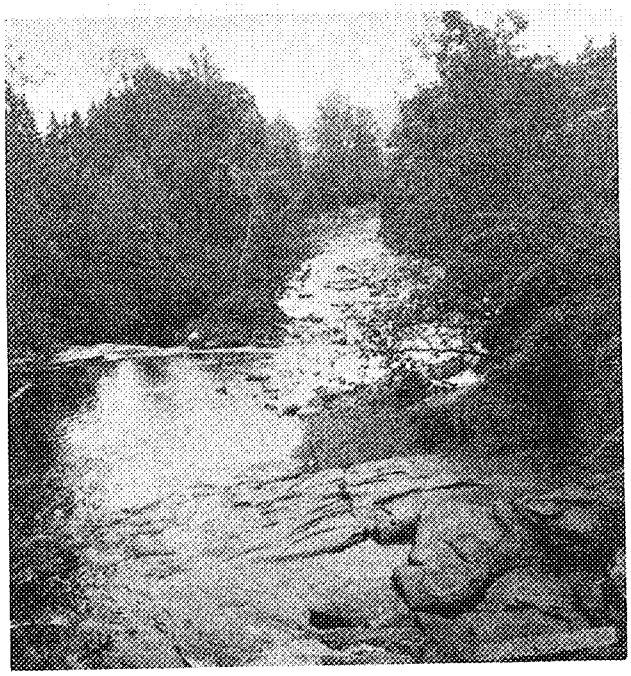


Fig. I - 28

ZONE II: MILLER RUN (Chamburlain Brook to Mathewson Brook).

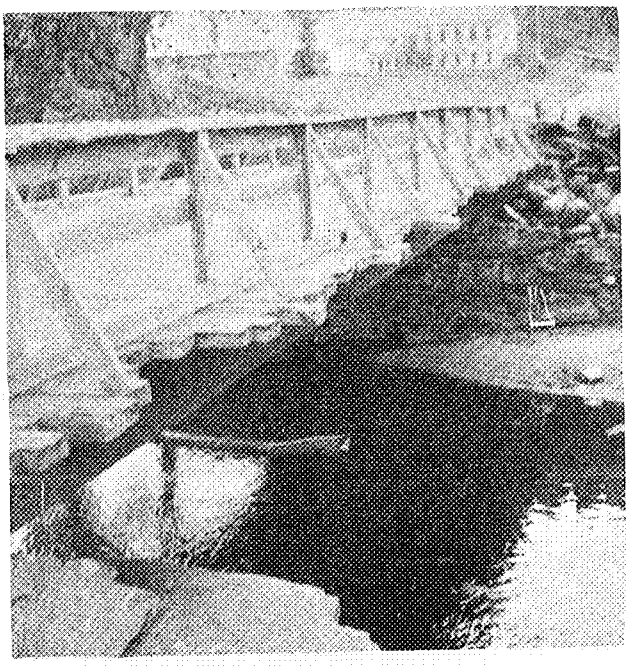


Fig. II - 1

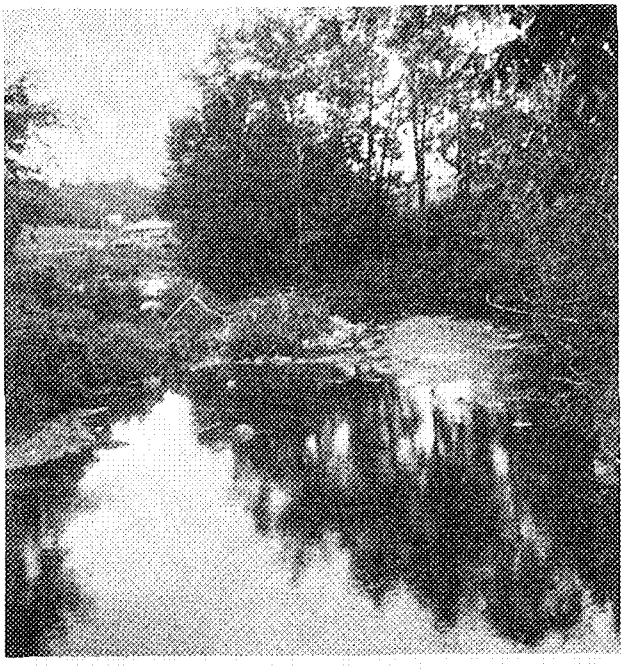


Fig. II - 2

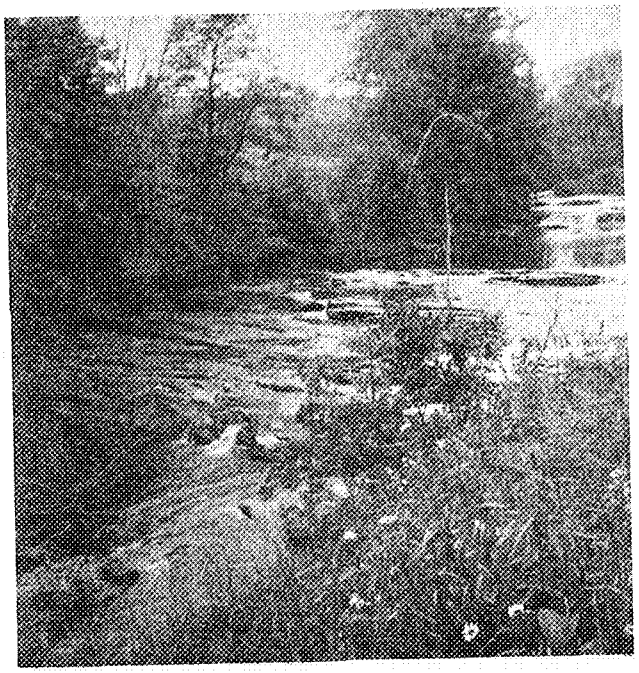


Fig. II - 3

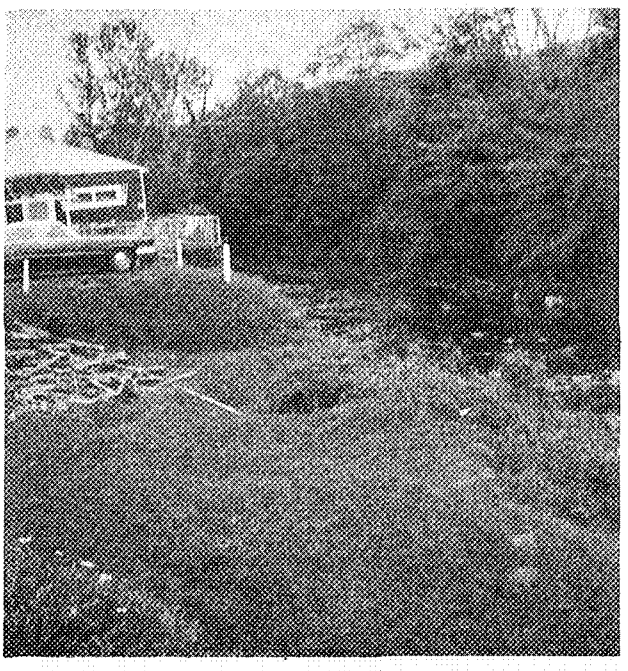


Fig. II - 4

ZONE II: MILLER RUN (Chamburlain Brook to Mathewson Brook).

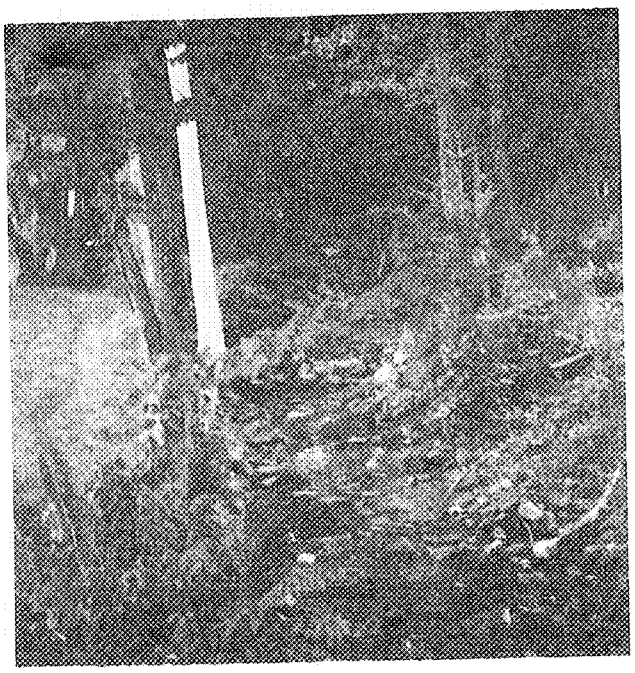


Fig. II - 5

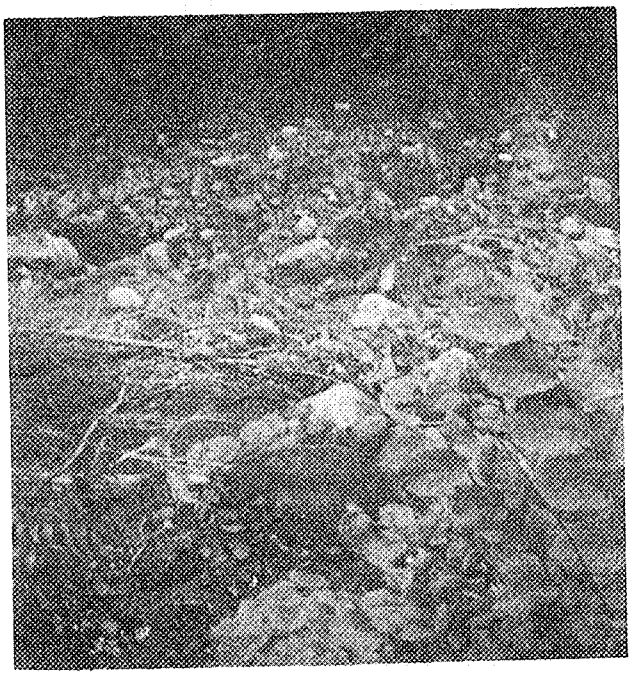


Fig. II - 6

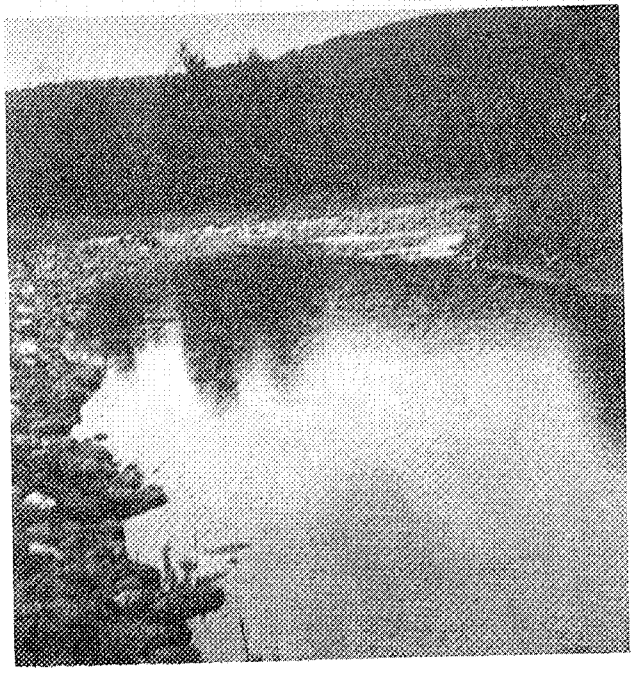


Fig. II - 7

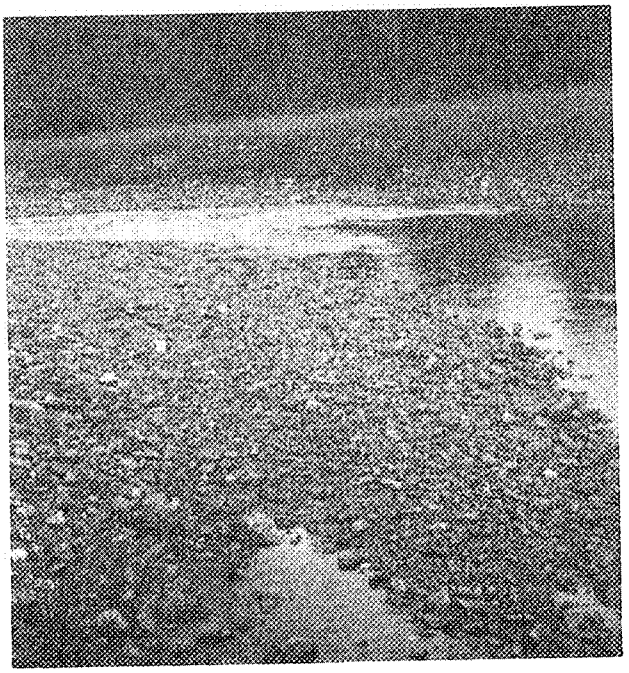


Fig. II - 8

ZONE II: MILLER RUN (Chamburlain Brook to Mathewson Brook)

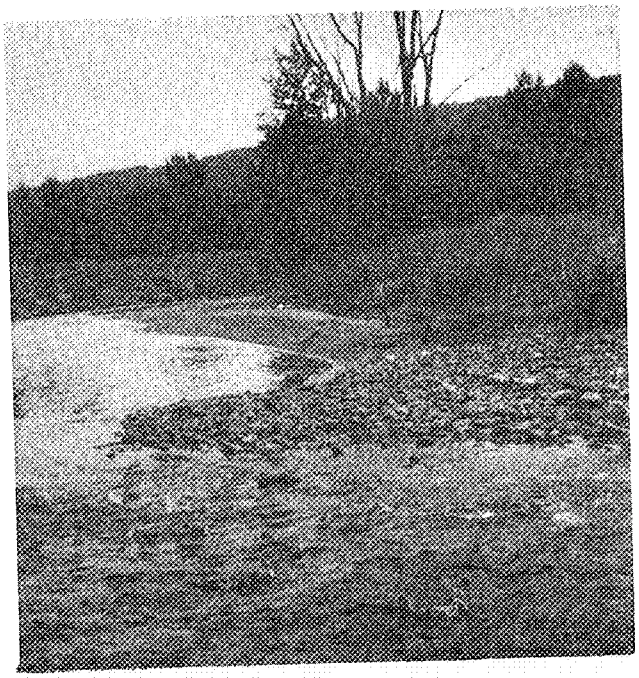


Fig. II - 9

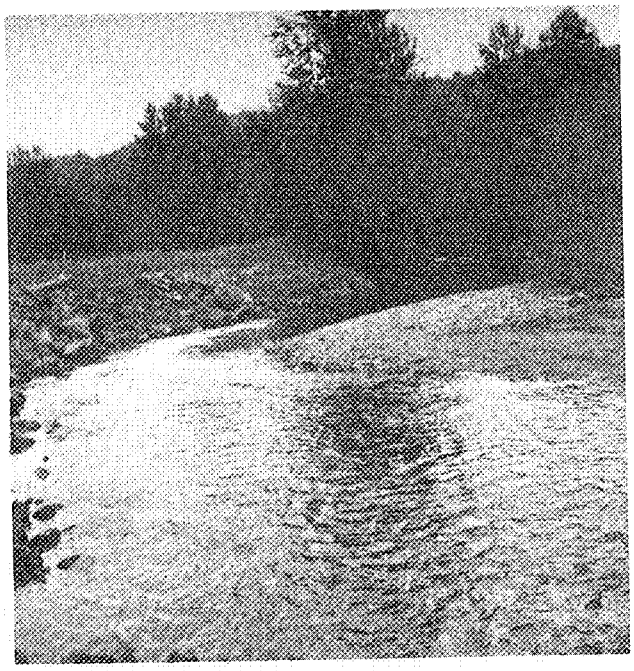


Fig. II - 10

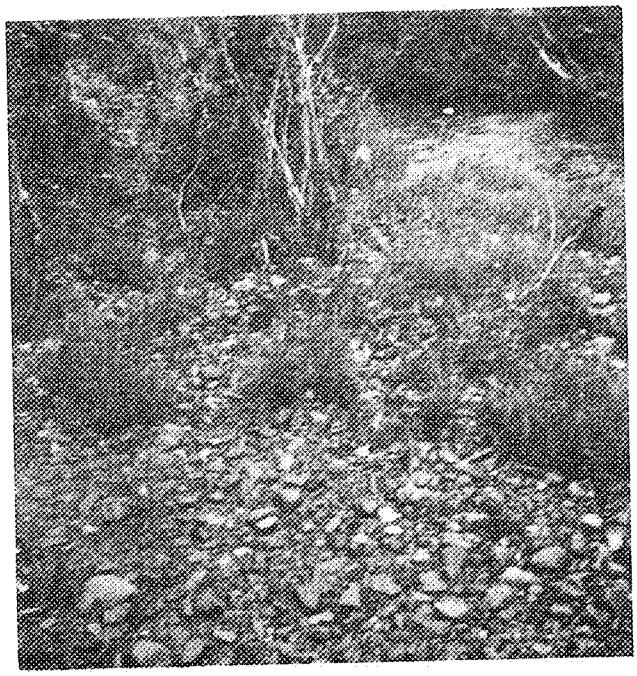


Fig. II - 11

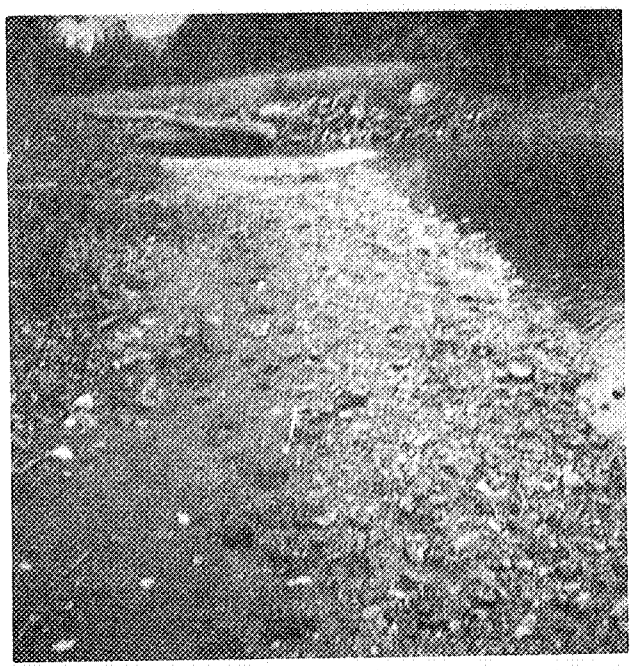


Fig. II - 12

ZONE II: MILLER RUN (Chamburlain Brook to Mathewson Brook).

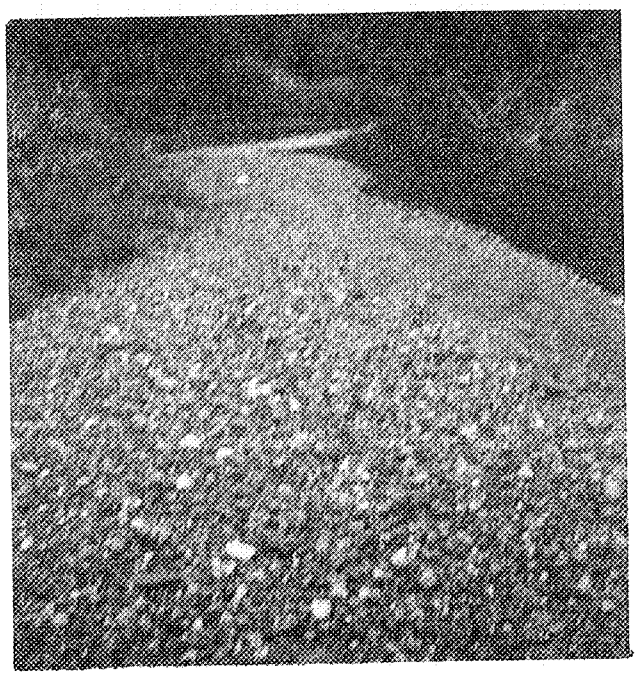


Fig. II - 13

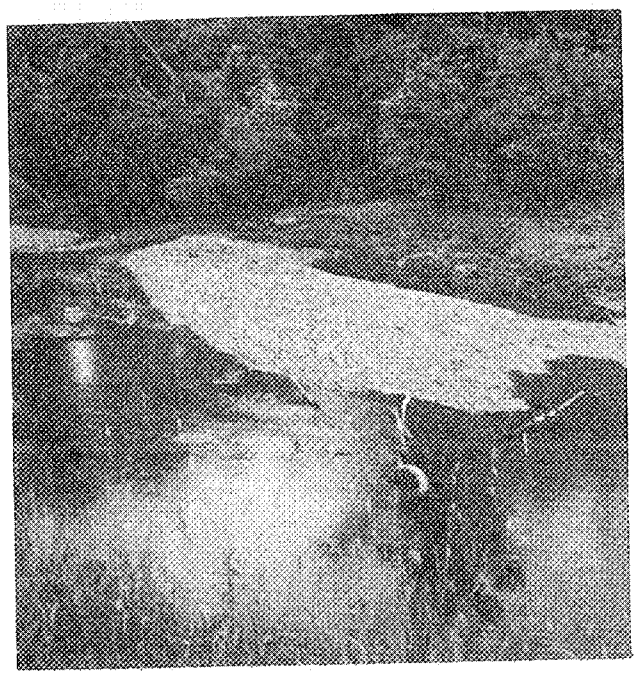


Fig. II - 14

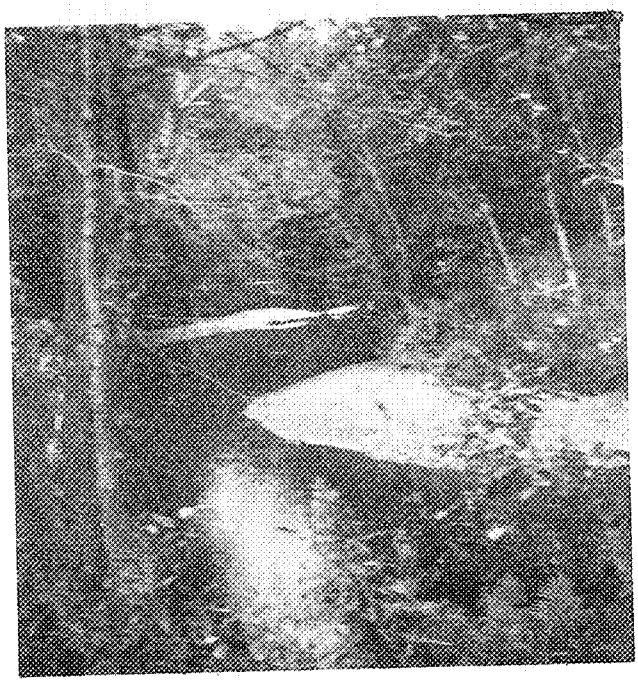


Fig. II - 15

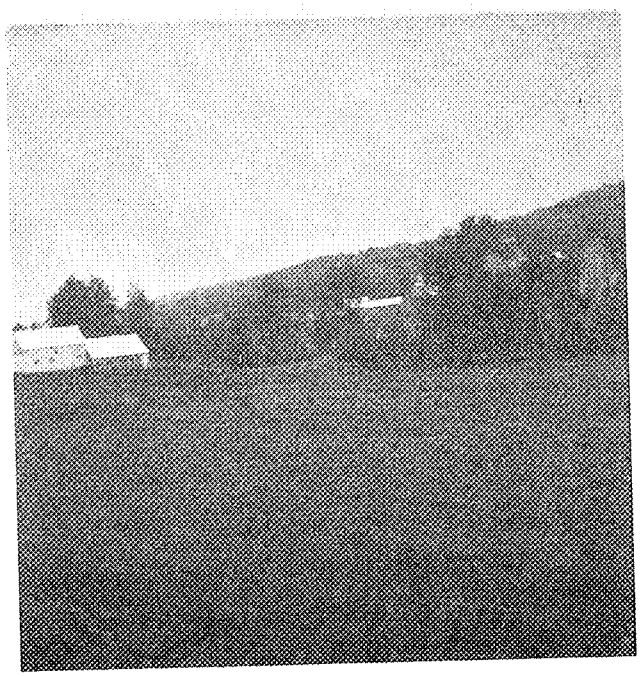


Fig. II - 16

ZONE II: MILLER RUN (Chamburlain Brook to Mathewson Brook).

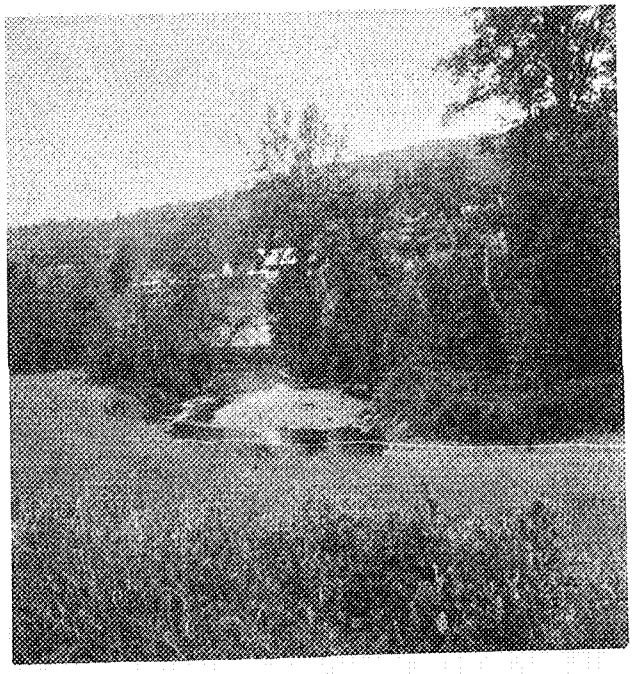


Fig. II - 17

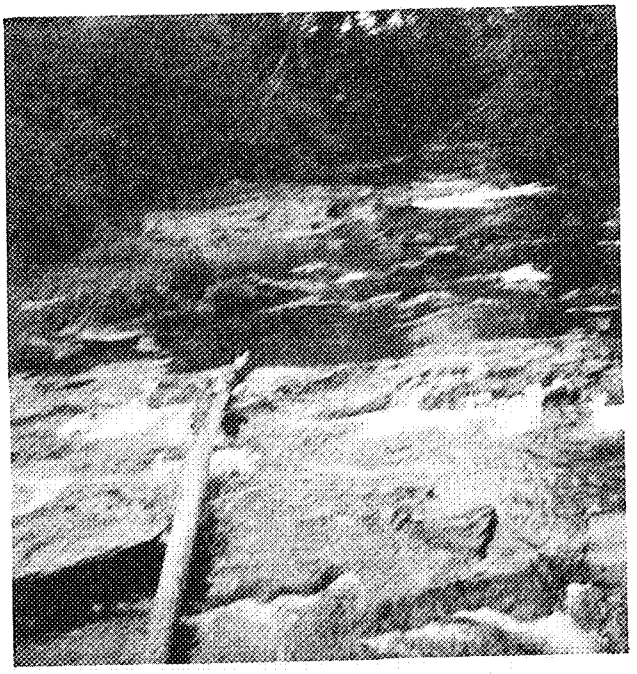


Fig. II - 18

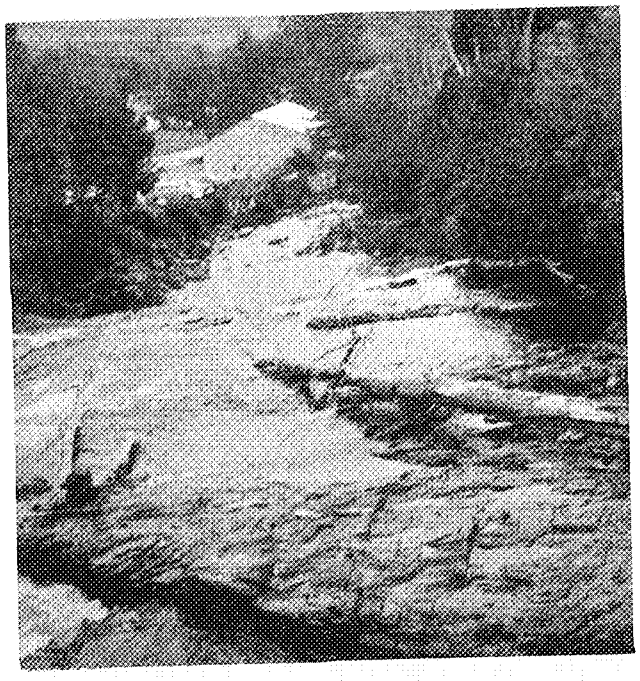


Fig. II - 19

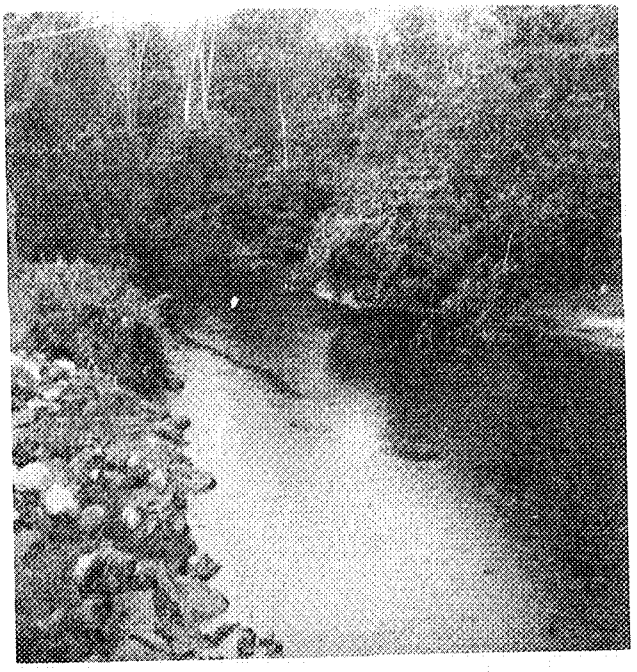


Fig. II - 20

ZONE III: MILLER RUN (Mathewson Brook to Tributary I).

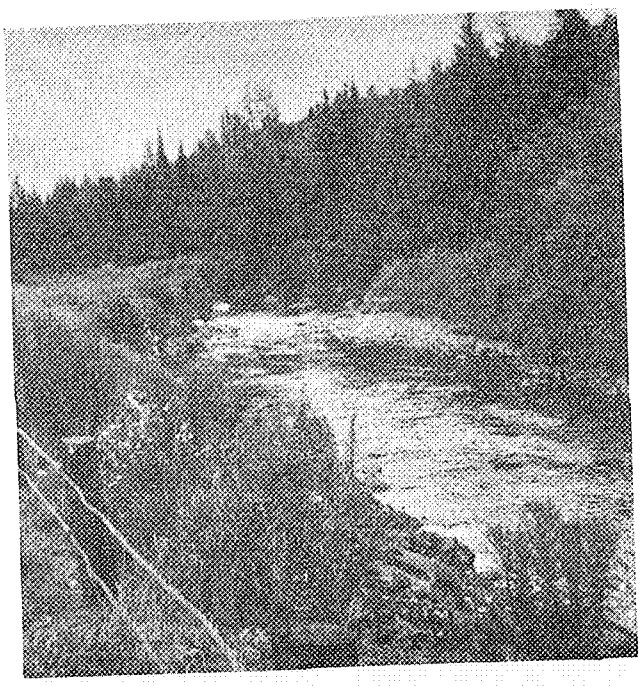


Fig. III - 1

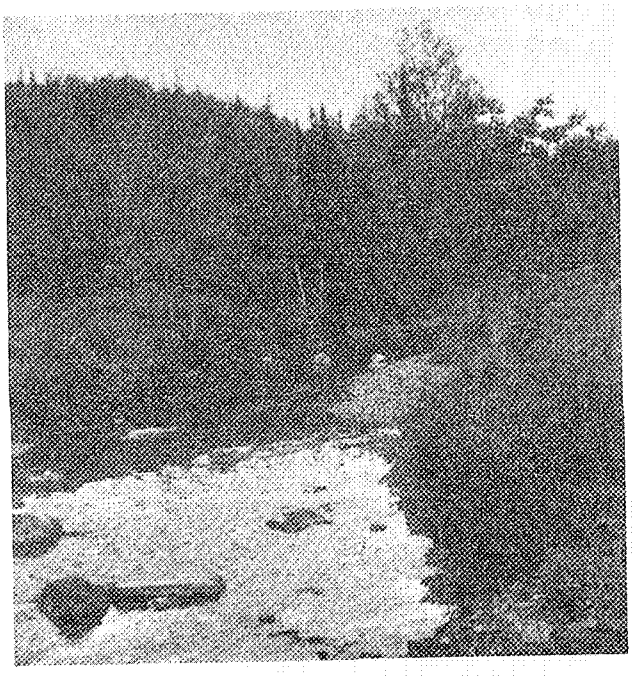


Fig. III - 2

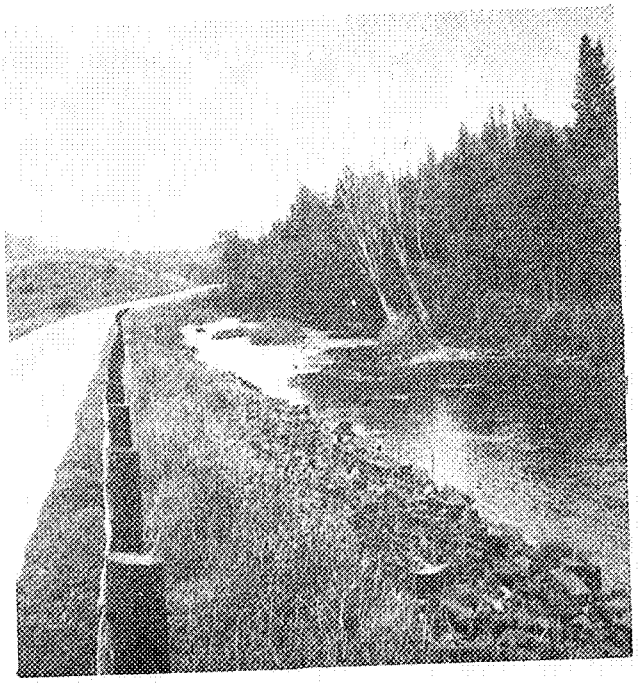


Fig. III - 3

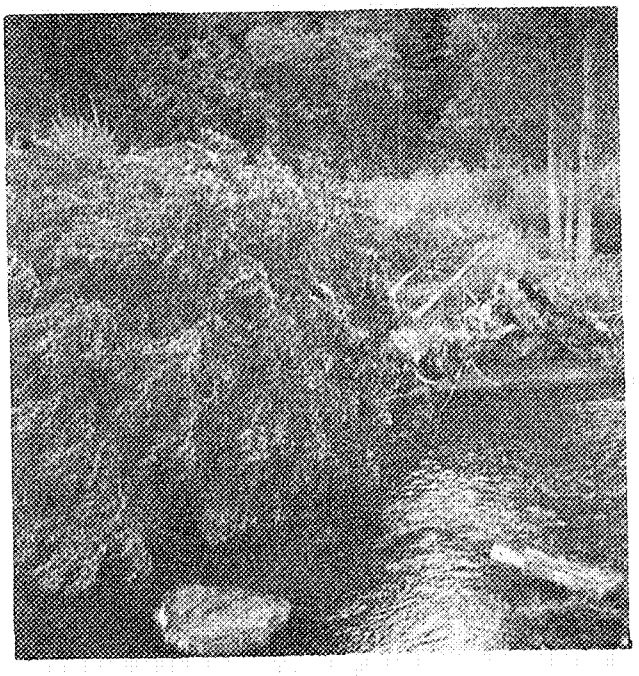


Fig. III - 4

ZONE III: MILLER RUN (Mathewson Brook to Tributary I).

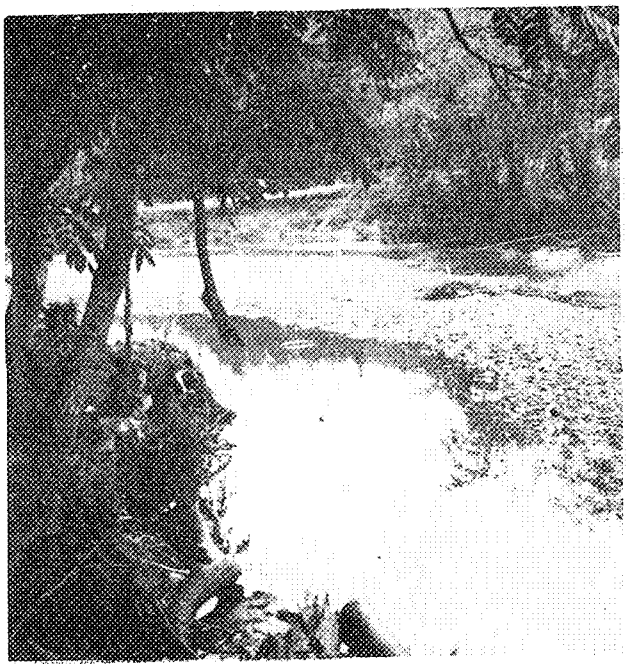


Fig. III - 5

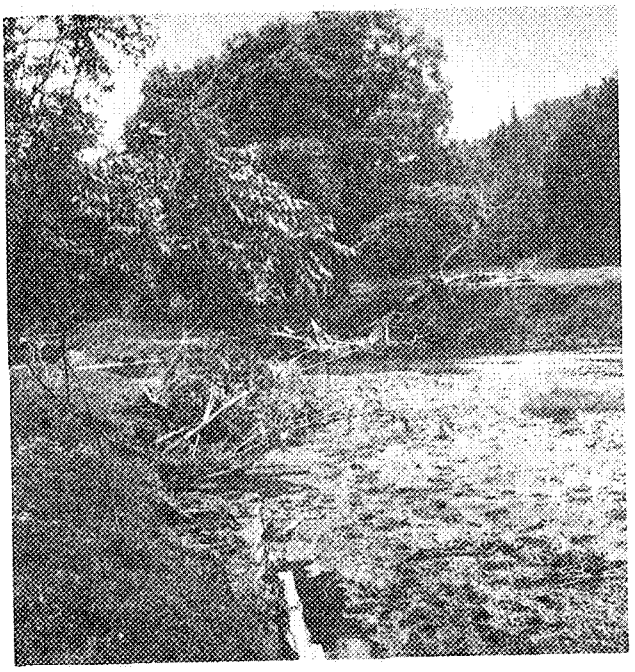


Fig. III - 6

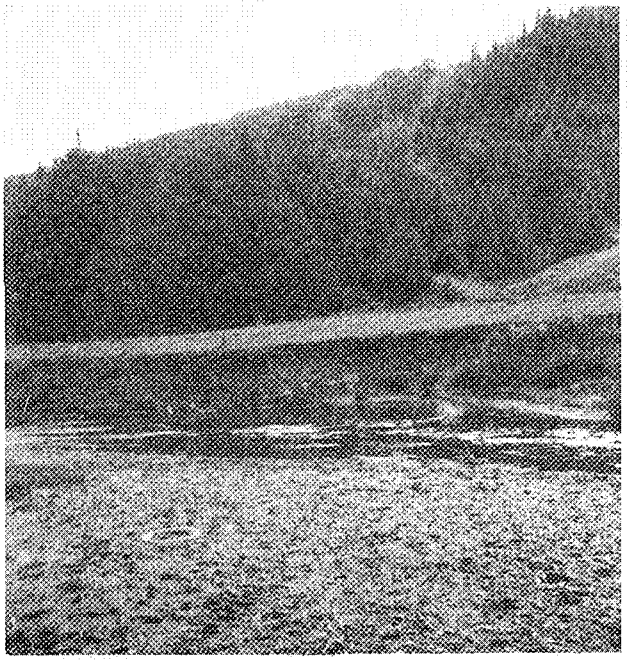


Fig. III - 7

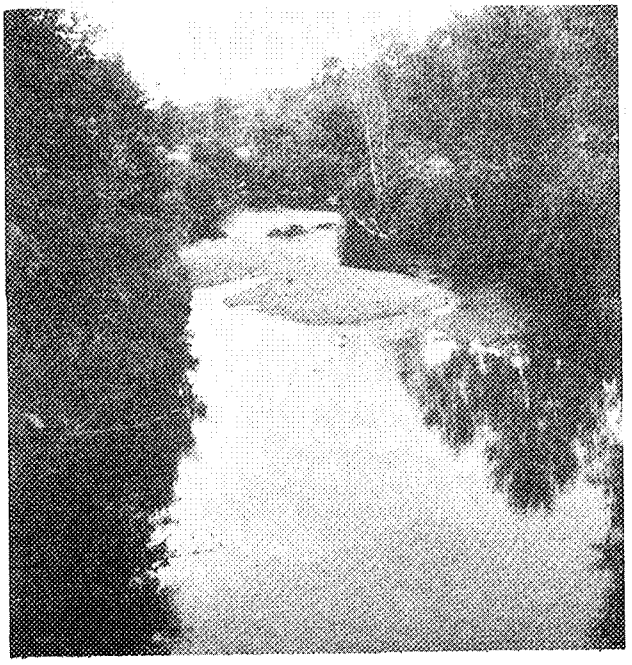


Fig. III - 8

ZONE IV: MILLER RUN (Tributary I to Passumpsic River).

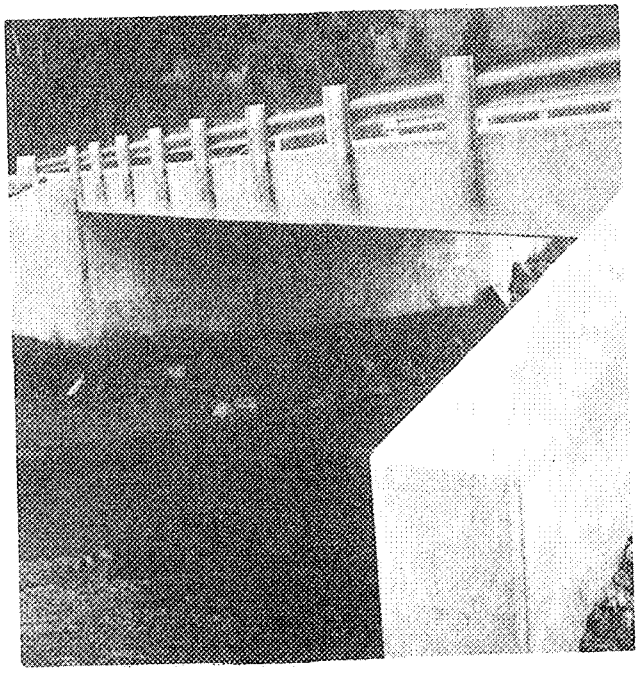


Fig. IV - 1

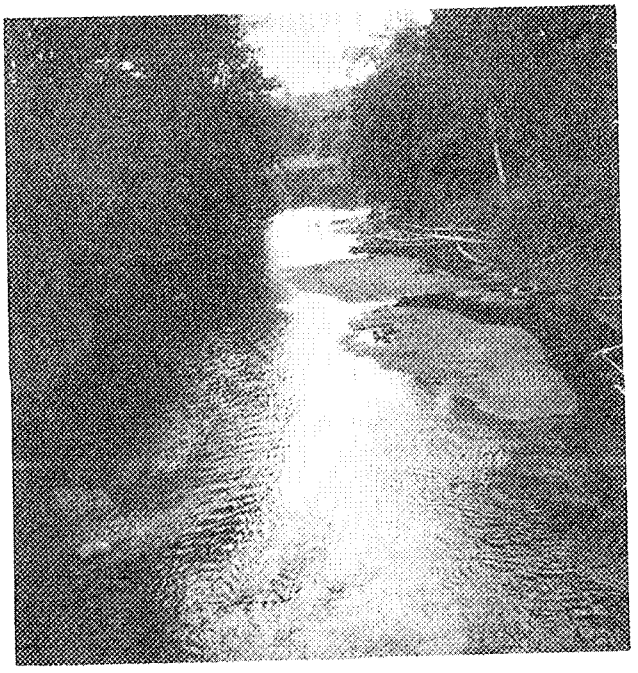


Fig. IV - 2

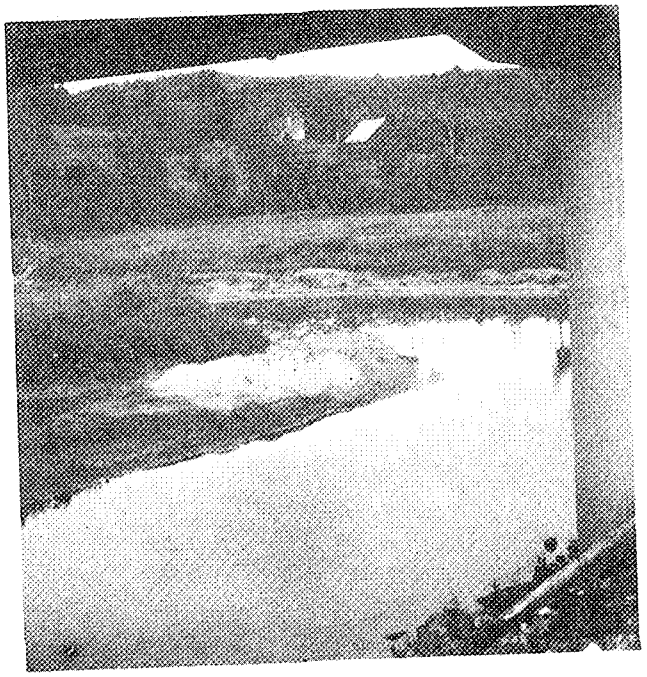


Fig. IV - 3

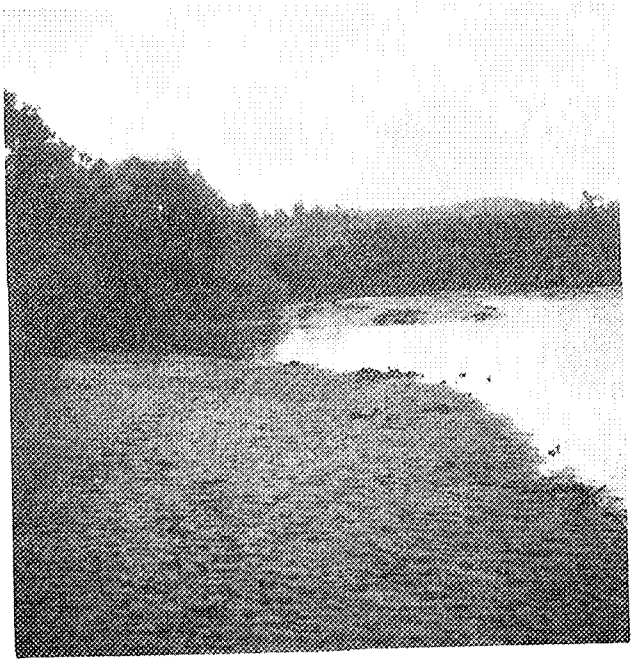


Fig. IV - 4

APPENDIX II

AYERS BROOK - PHOTOS

ZONE I: AYERS BROOK (Brookfield Gulf to Open Meadow Brook).

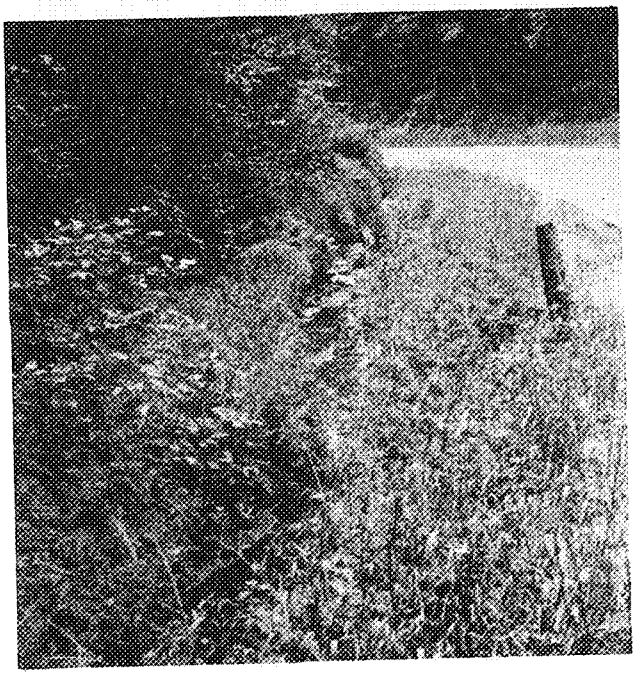


Fig. I - 1

Fig. I - 2

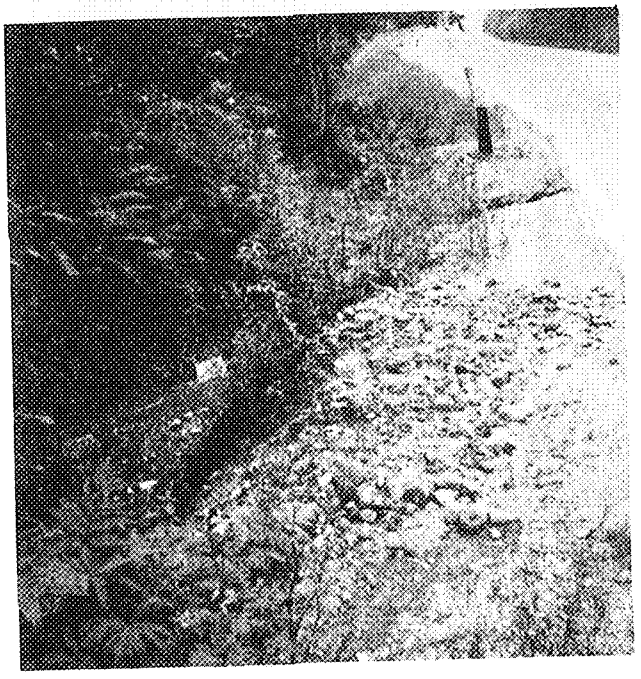


Fig. I - 3

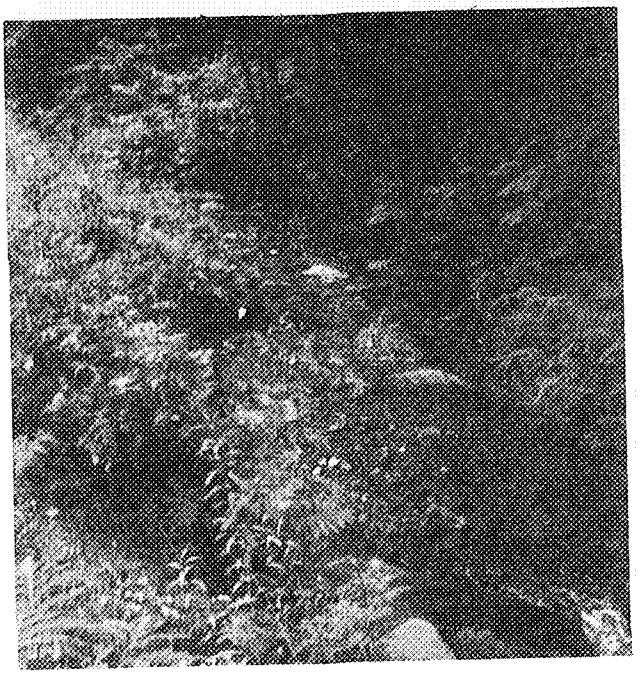


Fig. I - 4

ZONE I: AYERS BROOK (Brookfield Gulf to Open Meadow Brook).

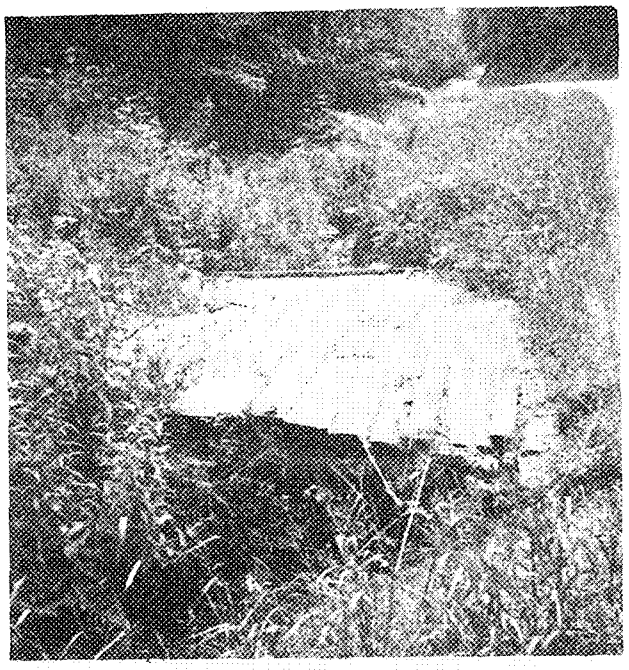


Fig. I - 5

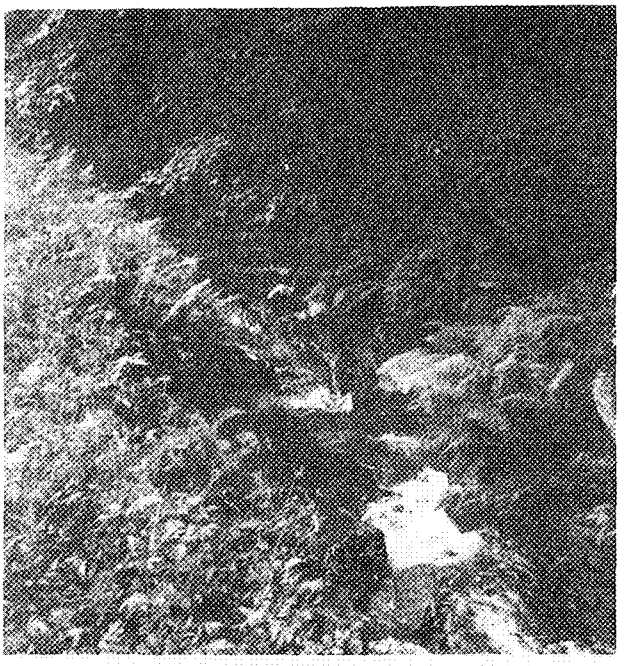


Fig. I - 6

Fig. I - 7

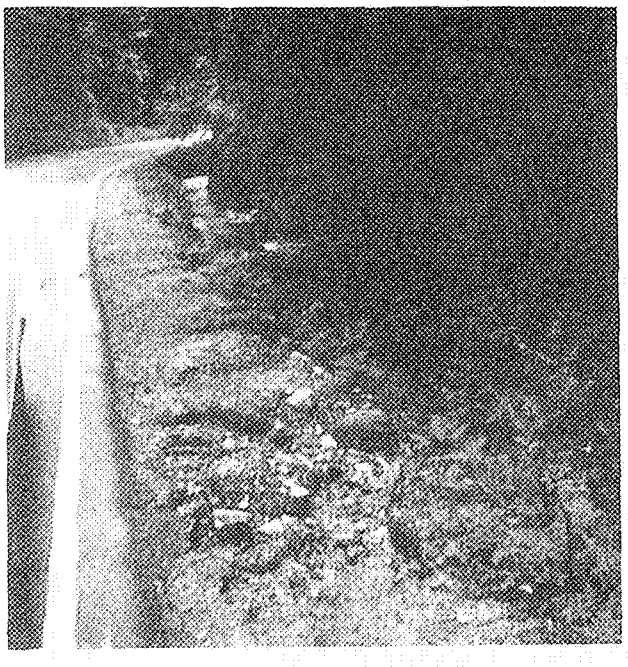


Fig. I - 8

ZONE I: AYERS BROOK (Brookfield Gulf to Open Meadow Brook).

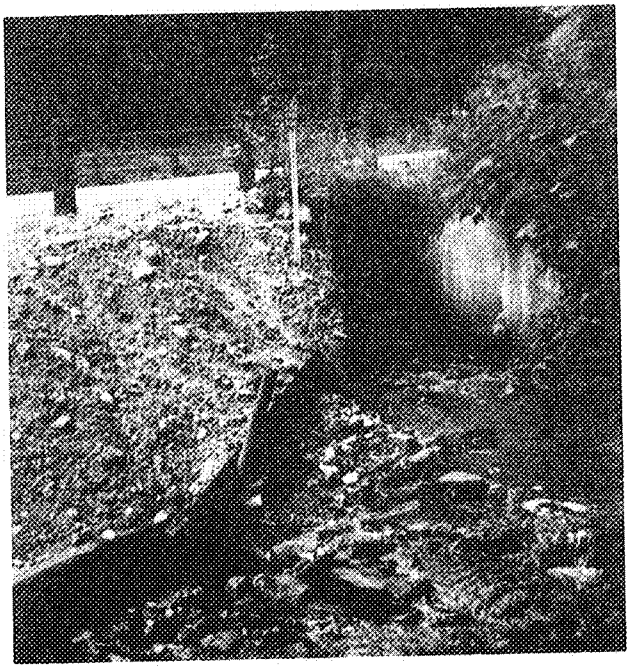


Fig. I - 9

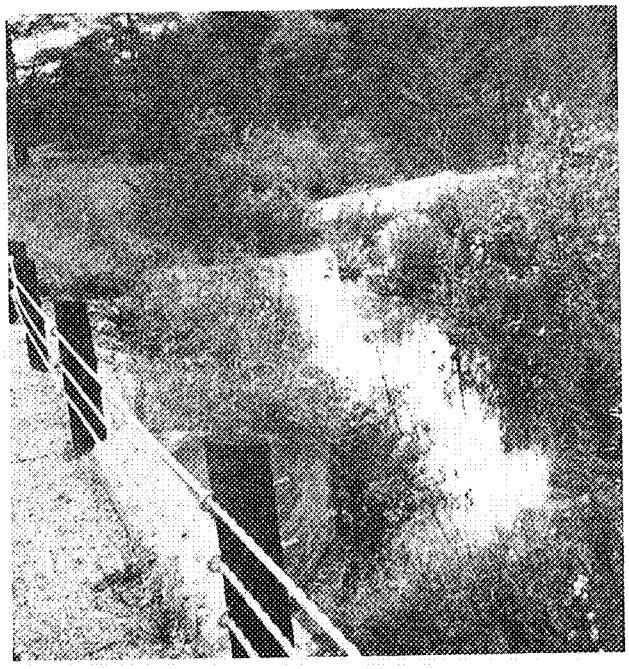


Fig. I - 10

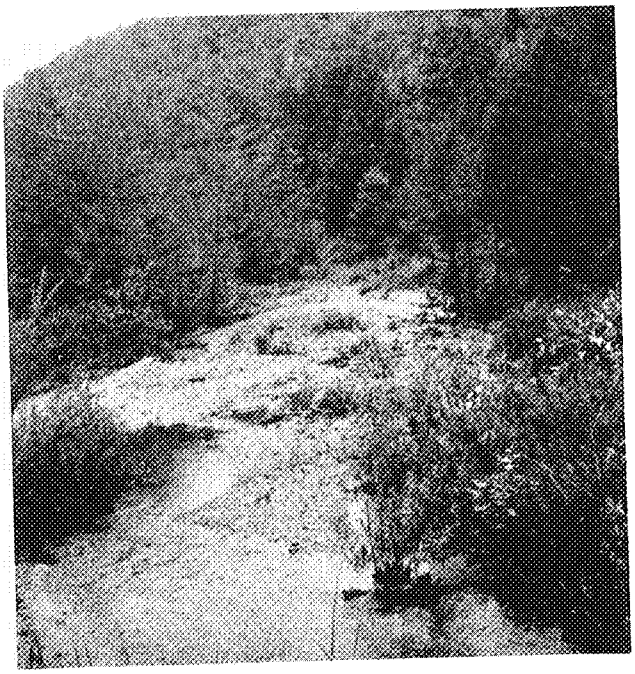


Fig. I - 11

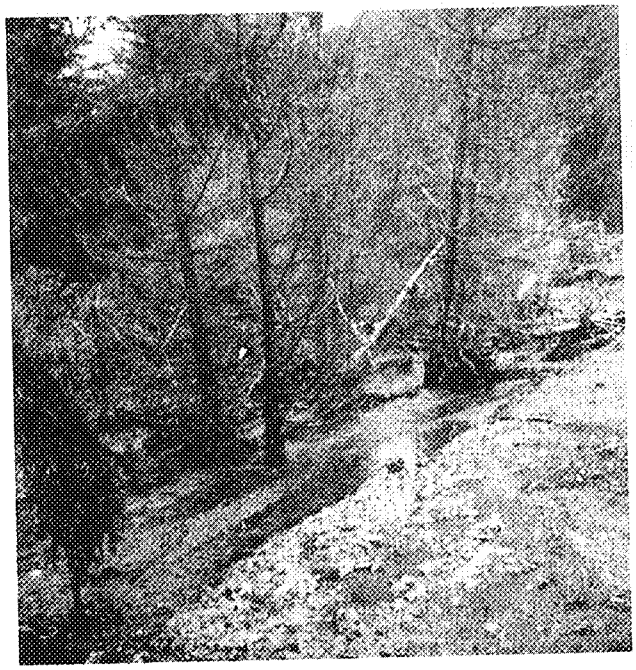


Fig. I - 12

ZONE I: AYERS BROOK (Brookfield Gulf to Open Meadow Branch).

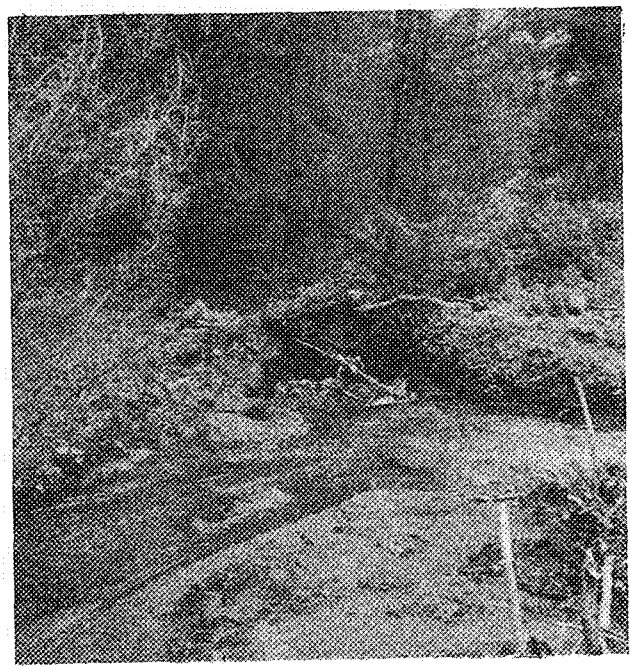


Fig. I - 13

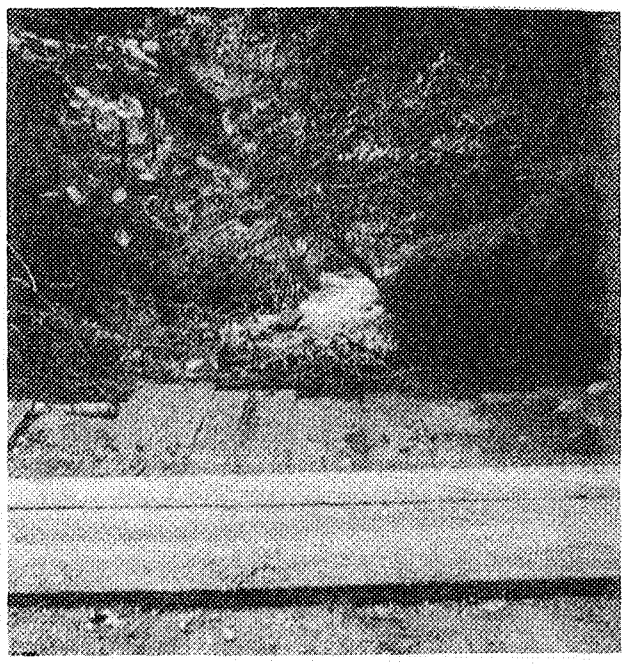


Fig. I - 14

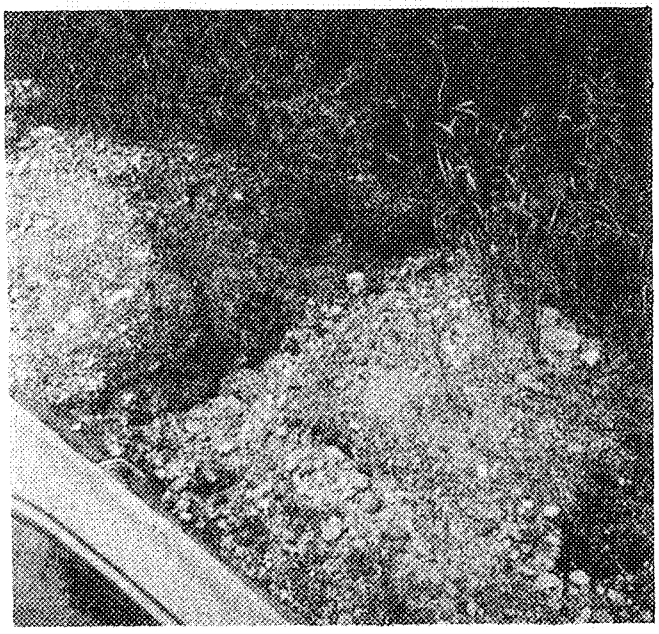


Fig. I - 15

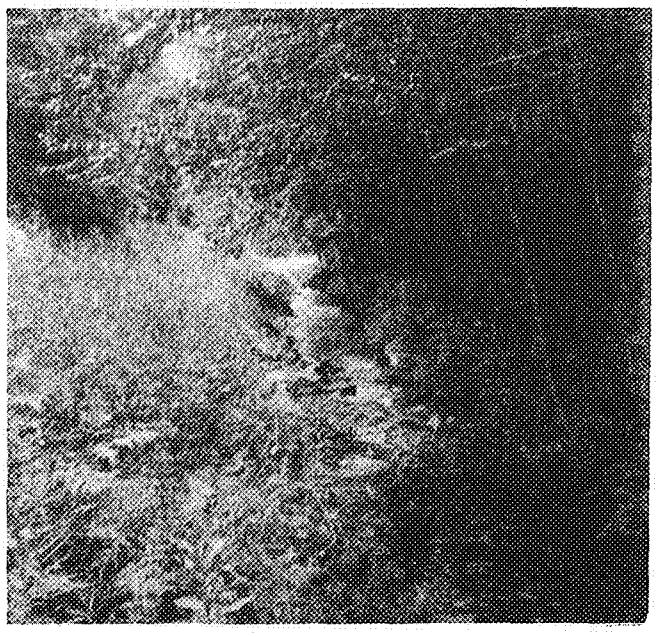


Fig. I - 16

ZONE I: AYERS BR OOK (Brookfield Gulf to Open Meadow Brook)

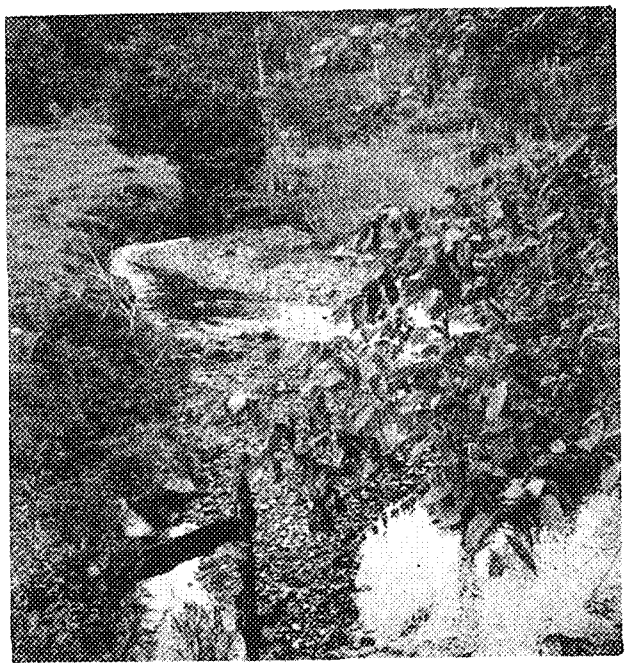


Fig. I - 17

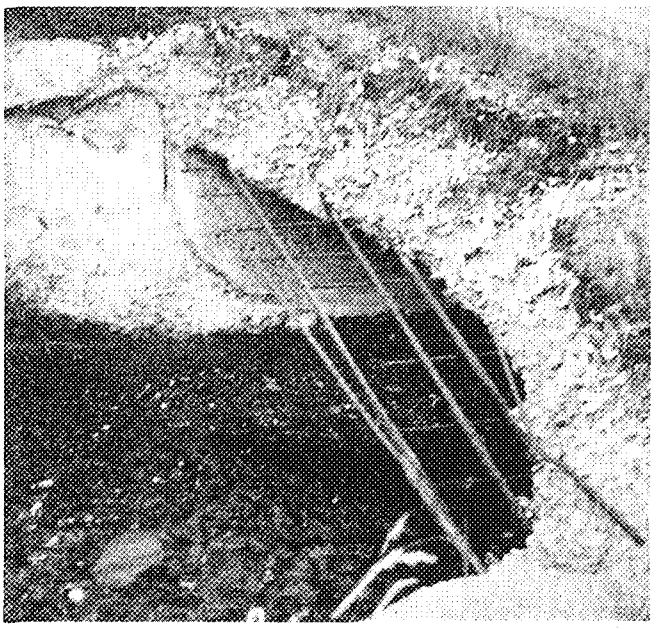


Fig. I - 18

ZONE II: AYERS BROOK (Open Meadow Brook to Tributary G).

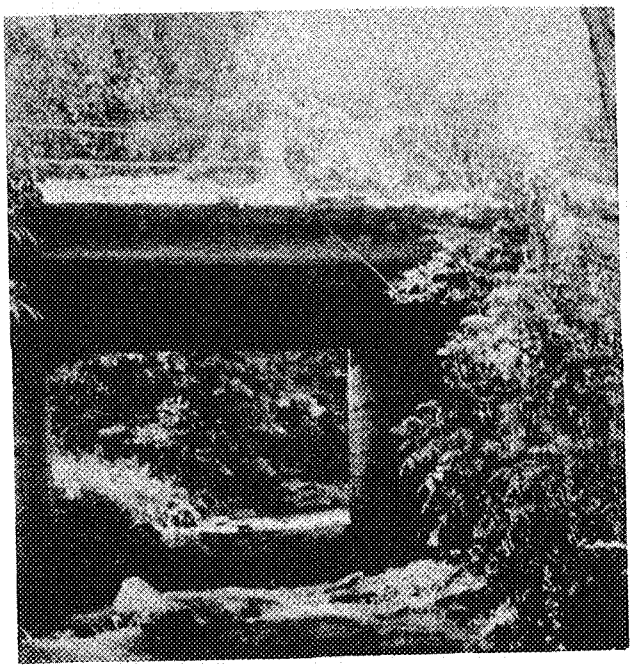


Fig. II - 1

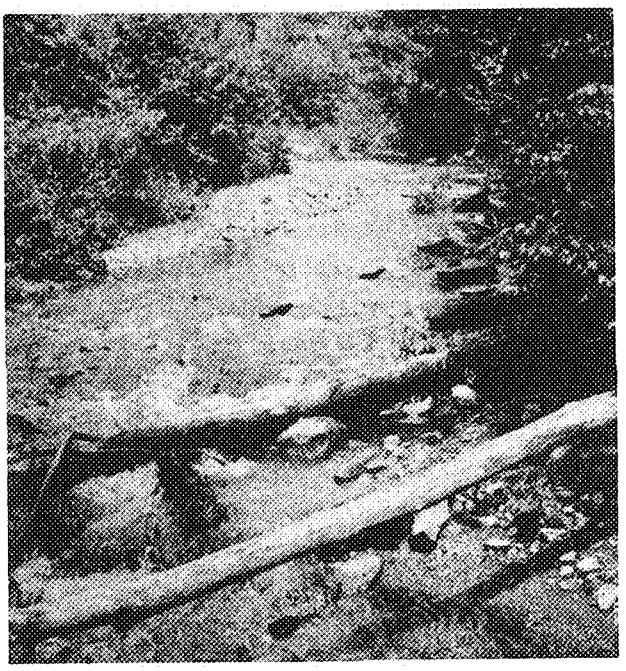


Fig. II - 2

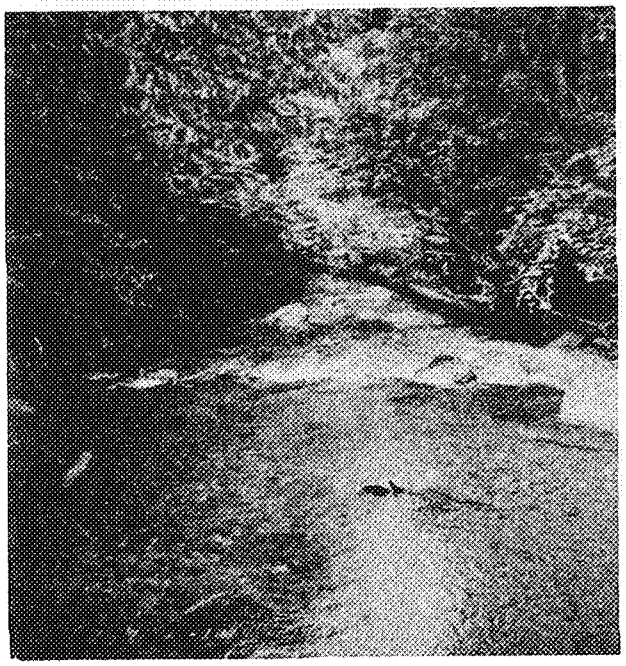


Fig. II - 3

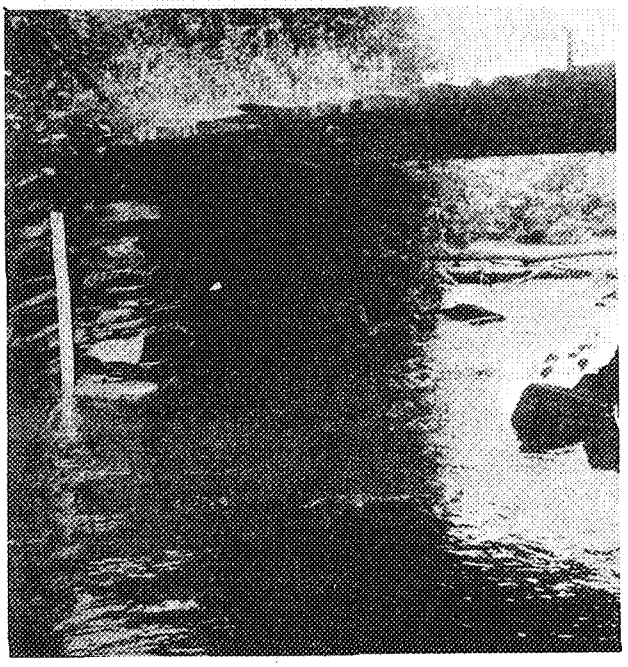


Fig. II - 4

ZONE II: AYERS BROOK (Open Meadow Brook to Tributary G).

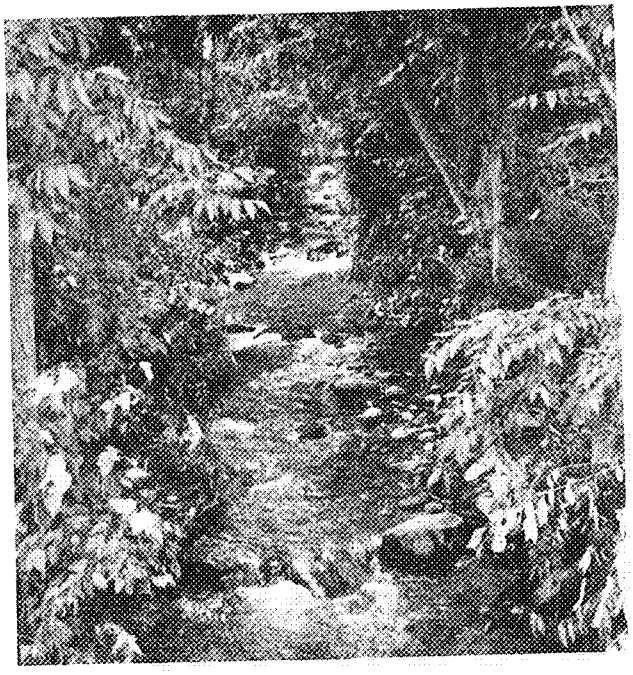


Fig. II - 5

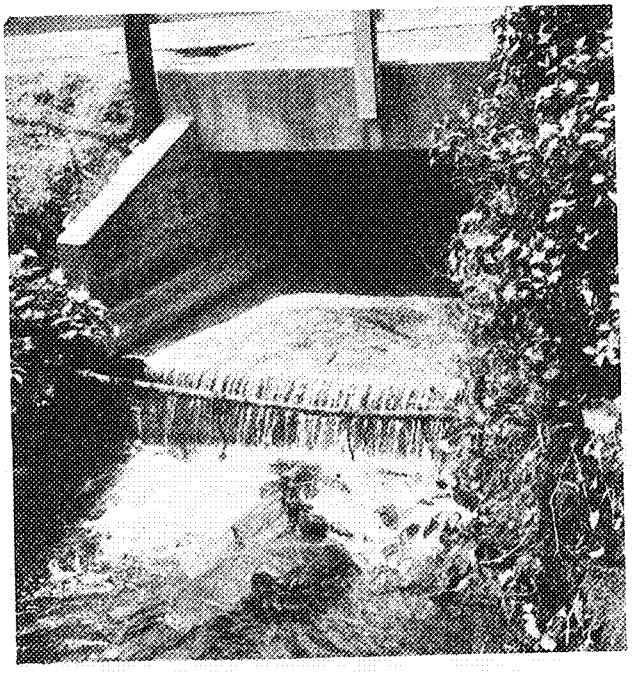


Fig. II - 6

Fig. II - 7

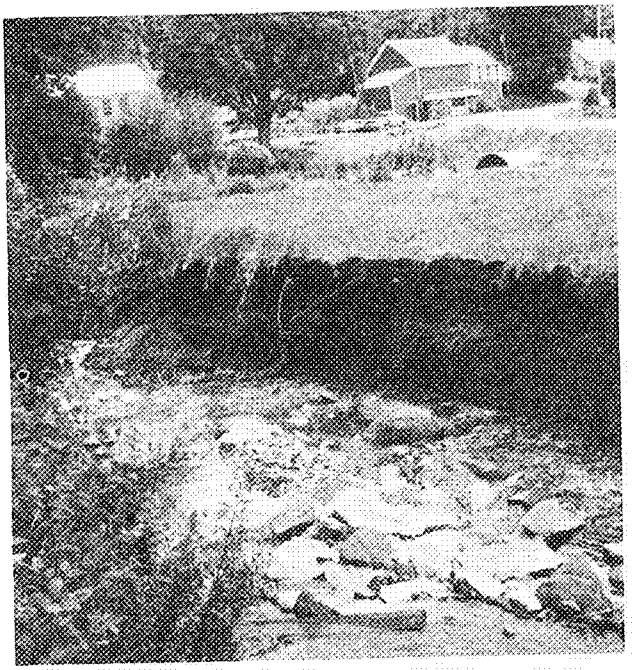


Fig. II - 8

ZONE II: AYERS BROOK (Open Meadow Brook to Tributary G.).

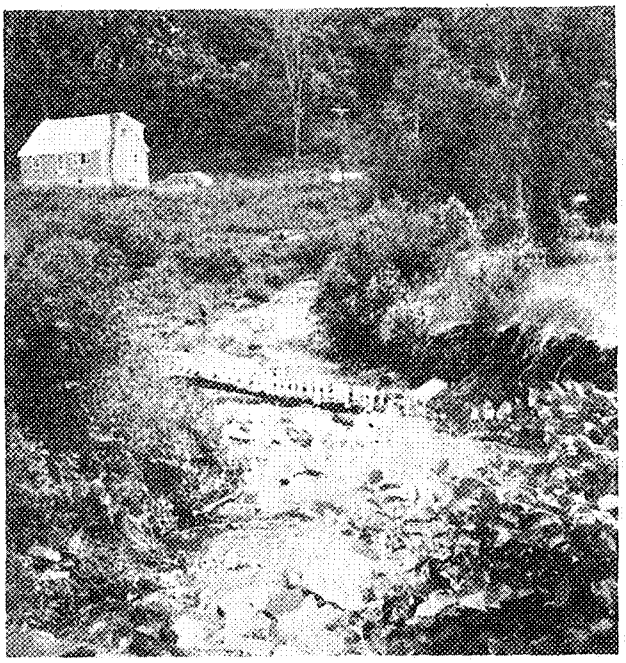


Fig. II - 9

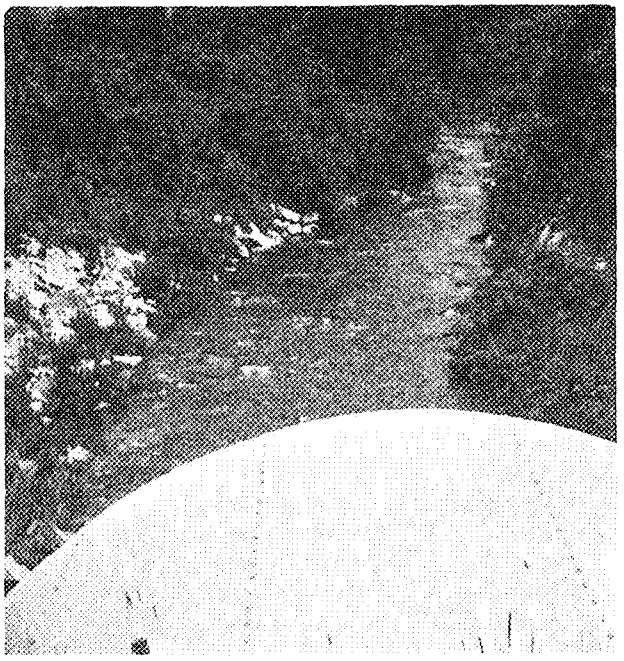


Fig. II - 10

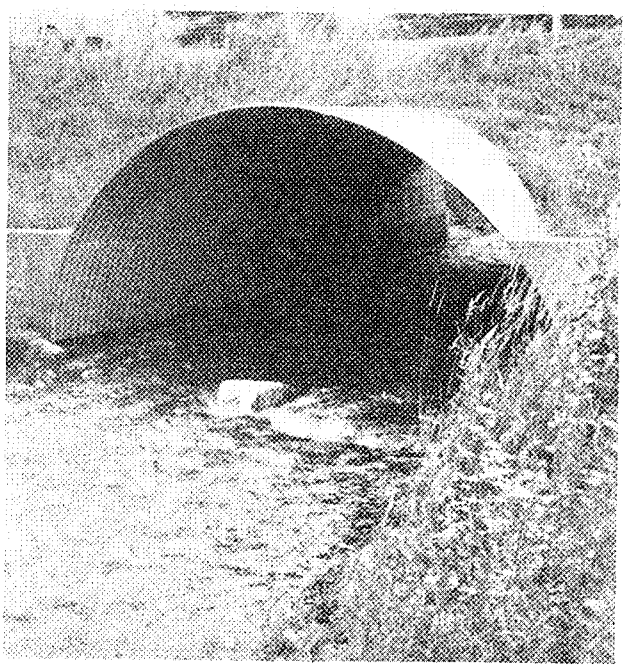


Fig. II - 11

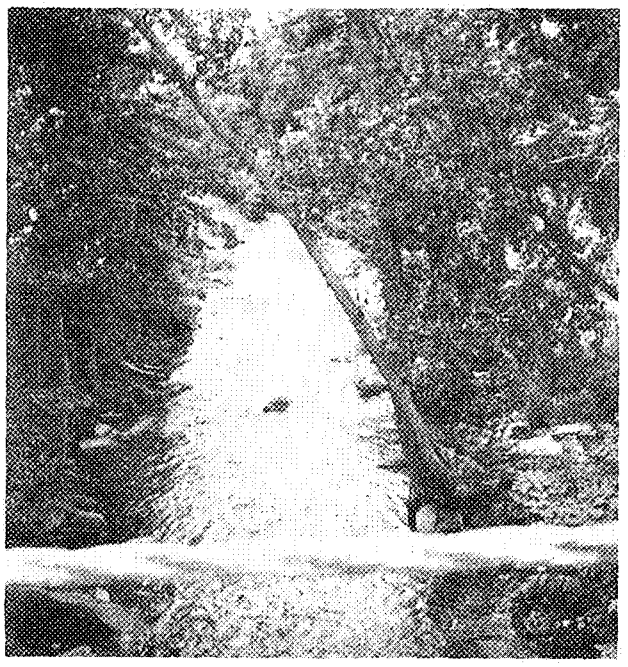


Fig. II - 12

ZONE II: AYERS BROOK (Open Meadow Brook to Tributary G).

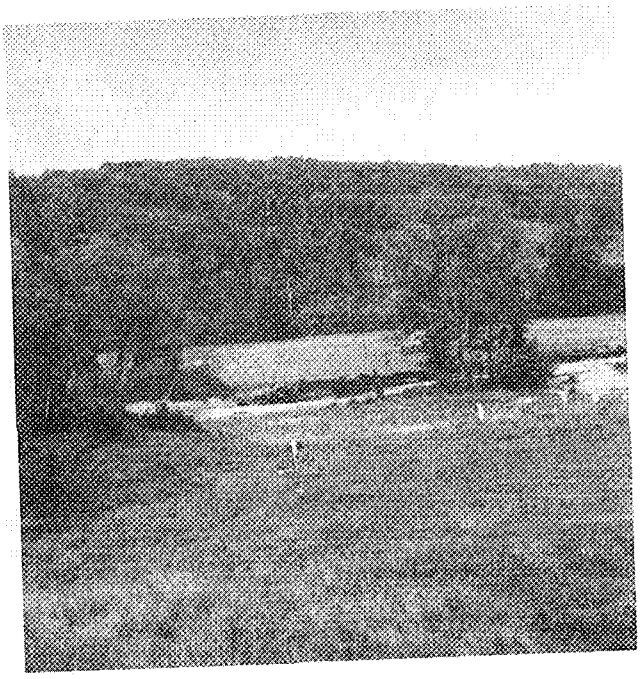


Fig. II - 17

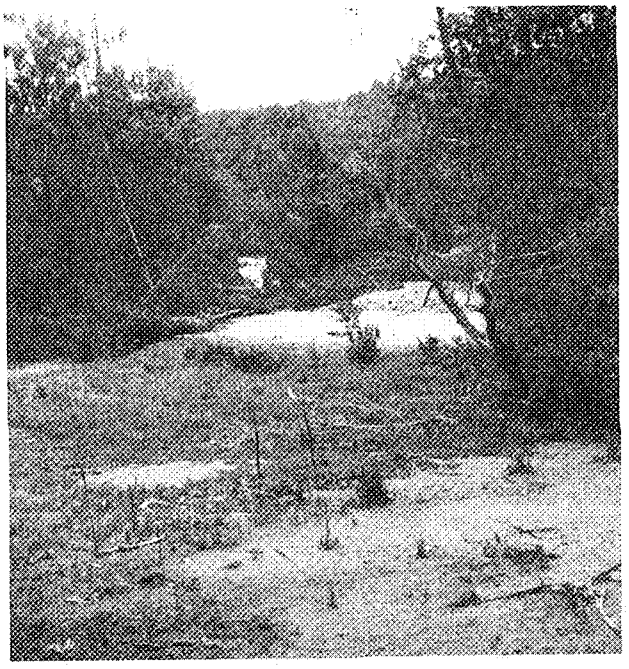


Fig. II - 18

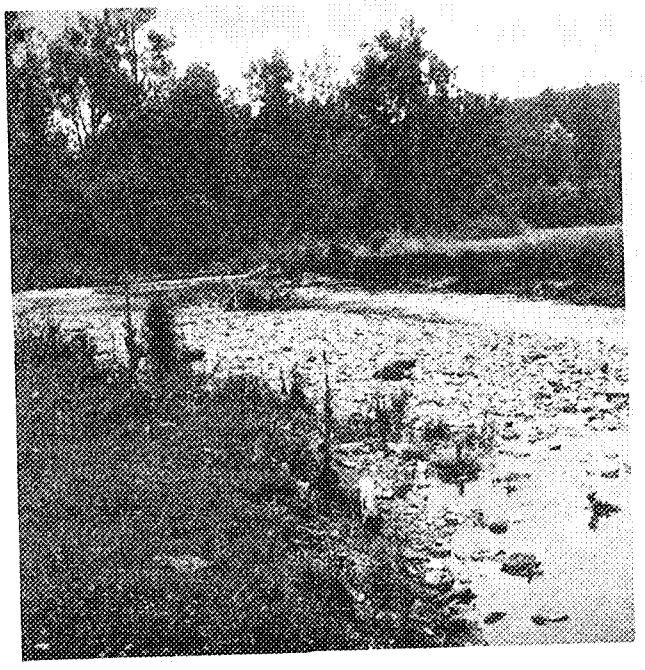


Fig. II - 19

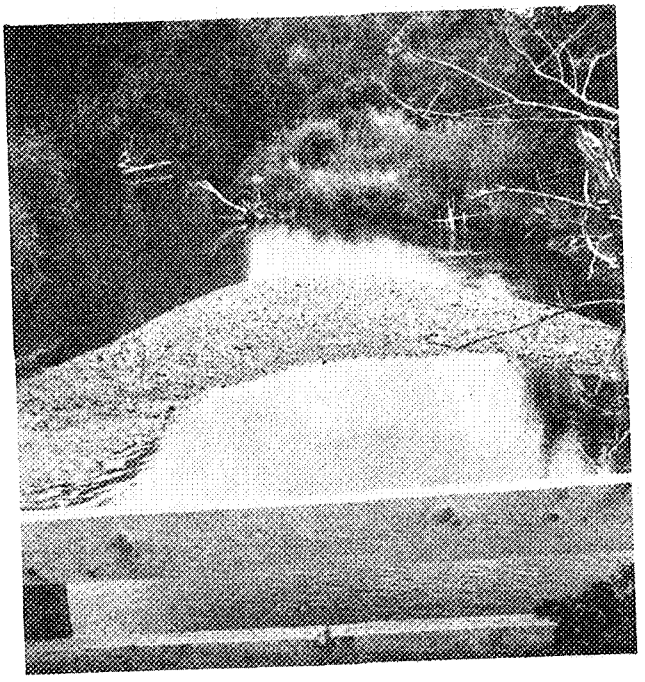


Fig. II - 20

ZONE III: AYERS BROOK (Tributary G to Tributary B).

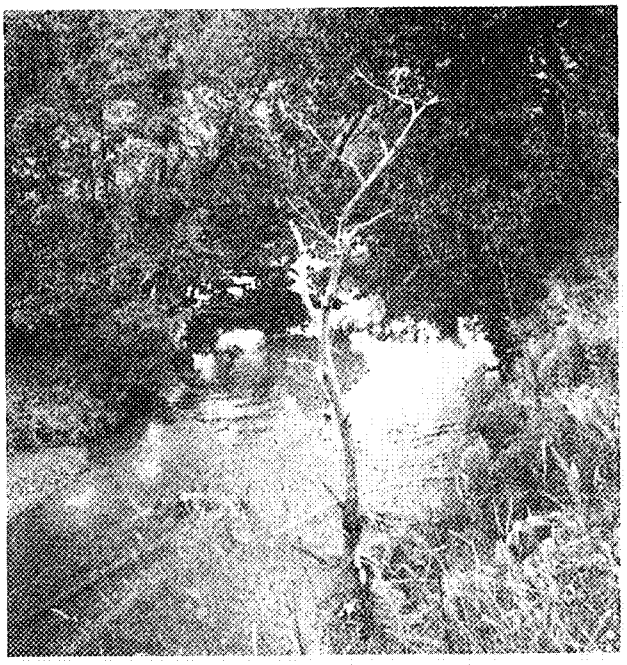


Fig. III - 5

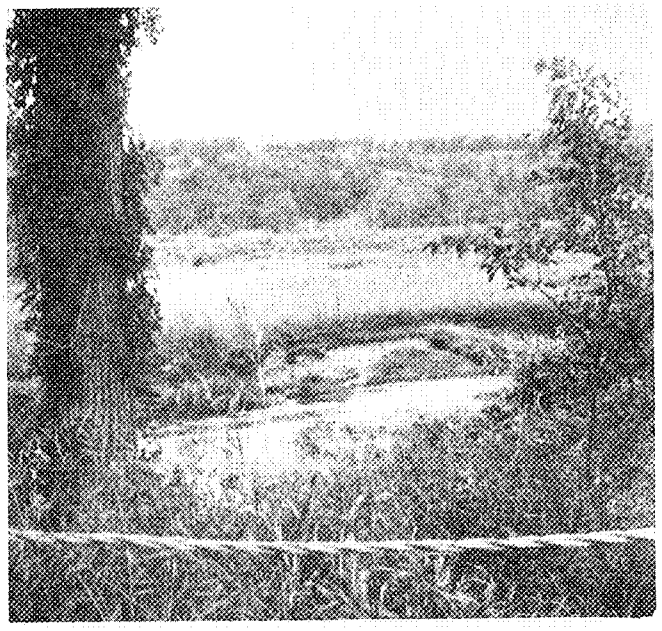


Fig. III - 6

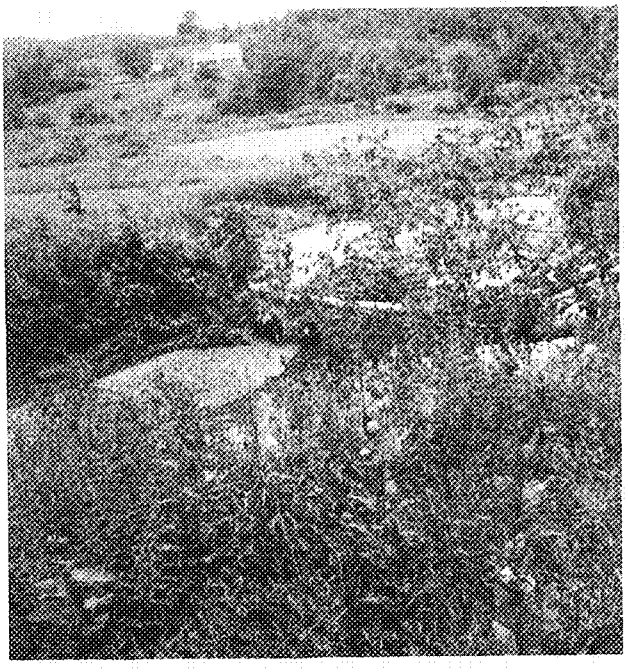


Fig. III - 7

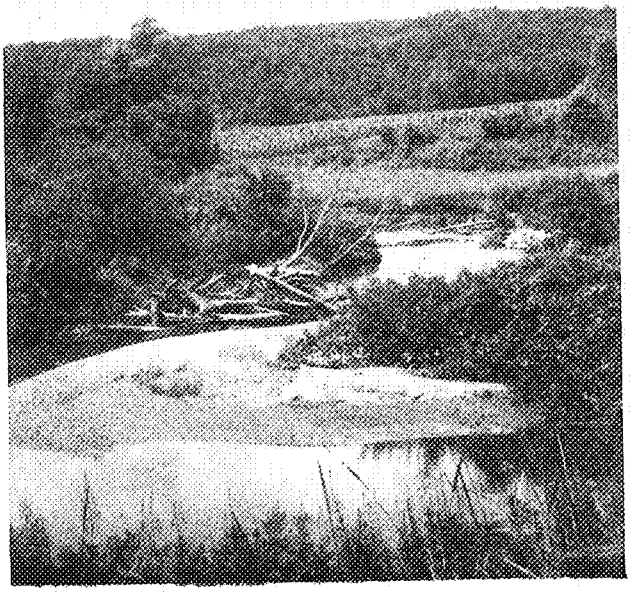


Fig. III - 8

ZONE III: AYERS BROOK (Tributary G to Tributary B)

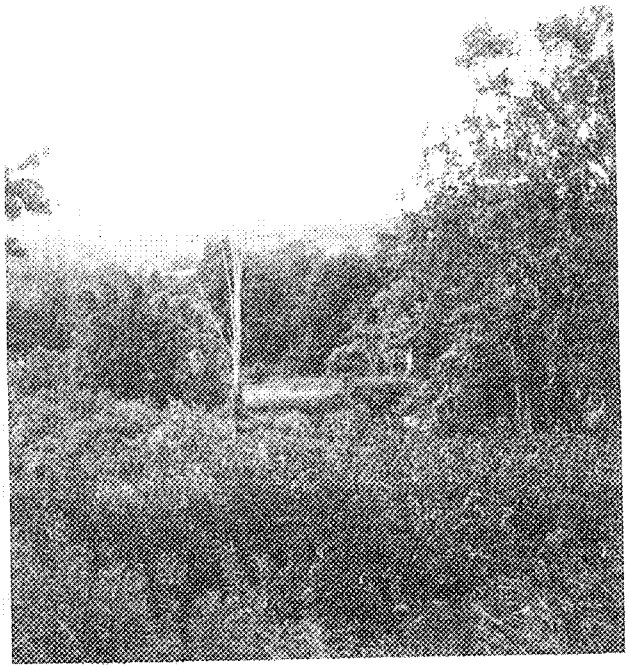


Fig. III - 9

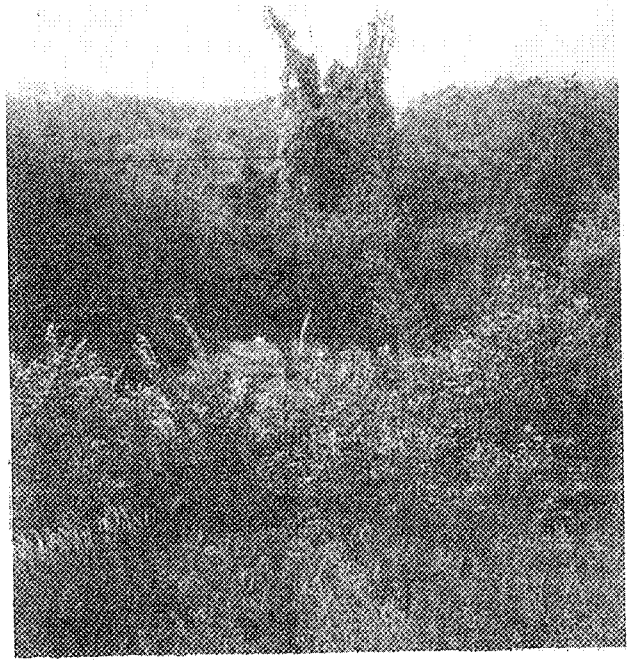


Fig. III - 10

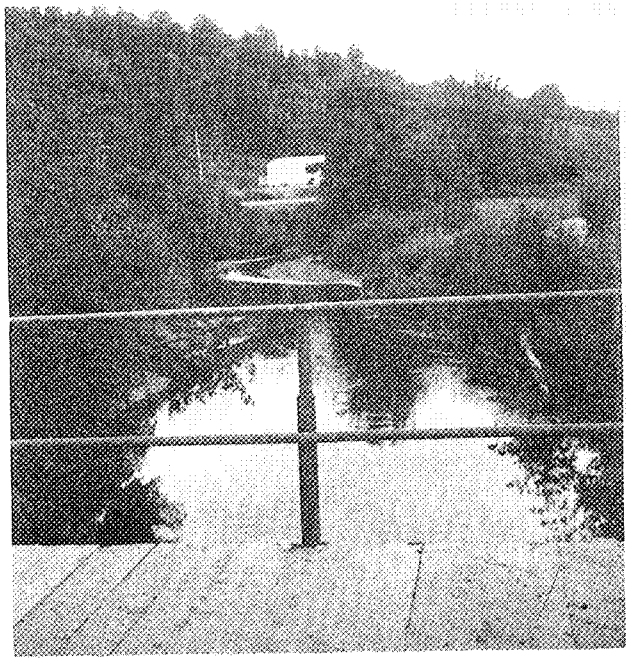


Fig. III - 11

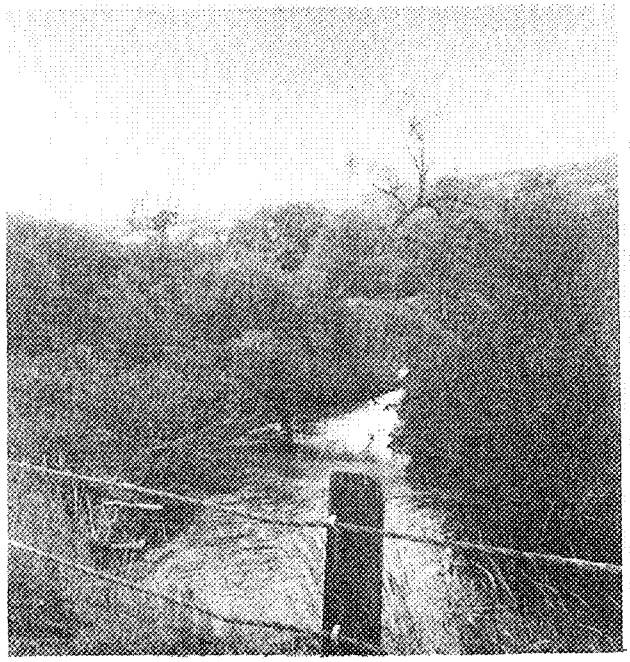


Fig. III - 12

ZONE IV: AYERS BROOK (Tributary G to Third White River Branch).

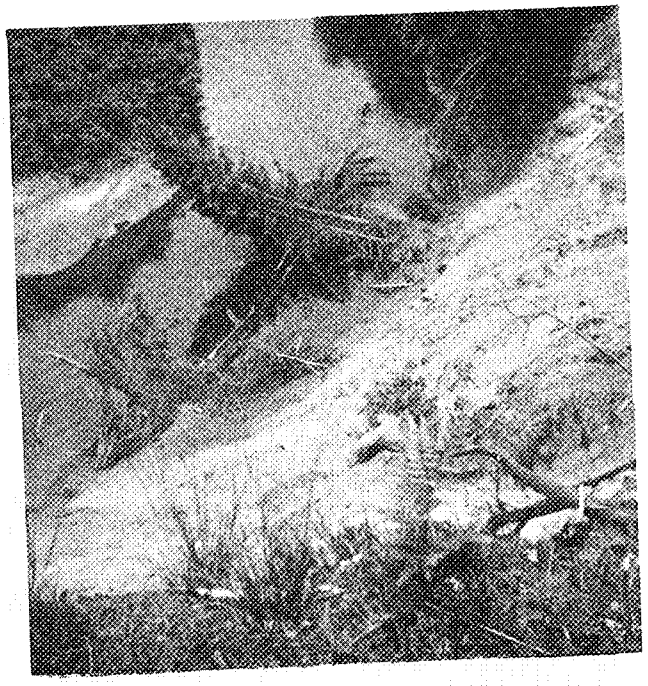


Fig. IV - 1

Fig. IV - 2

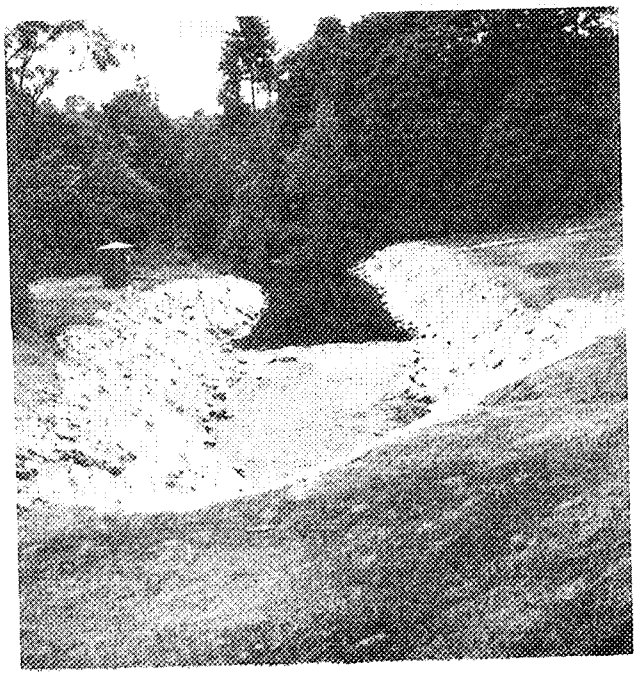


Fig. IV - 3

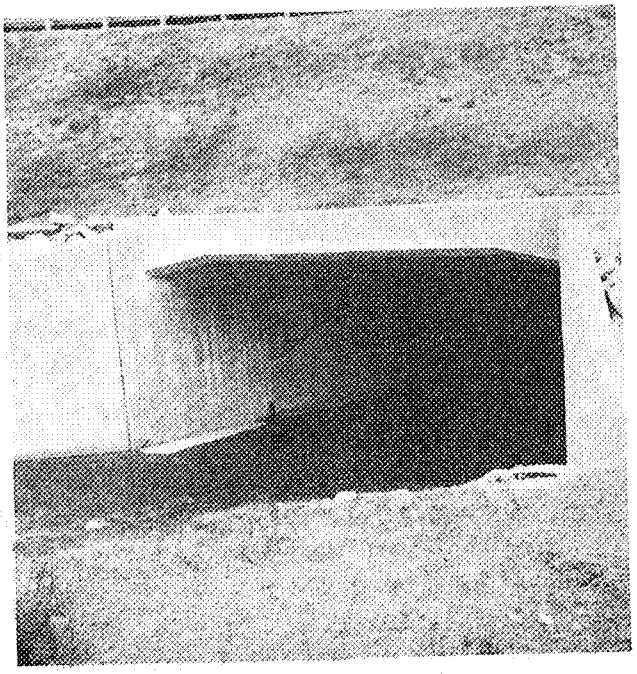


Fig. IV - 4

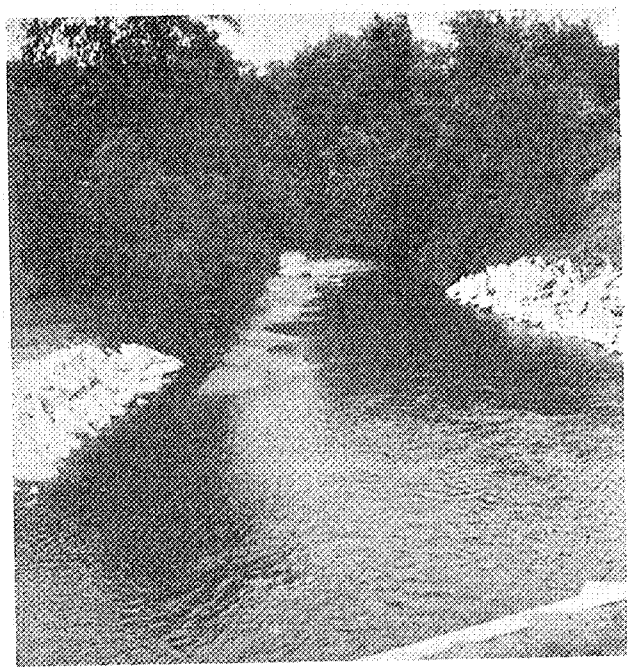


Fig. IV - 5

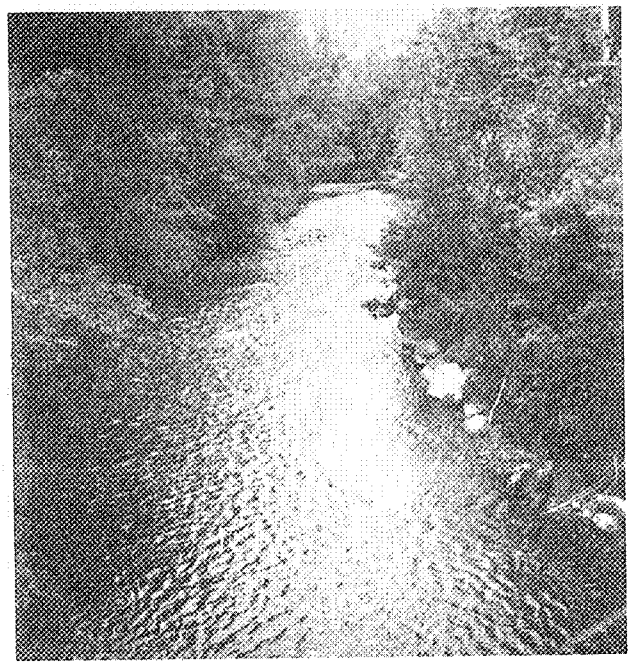


Fig. IV - 6

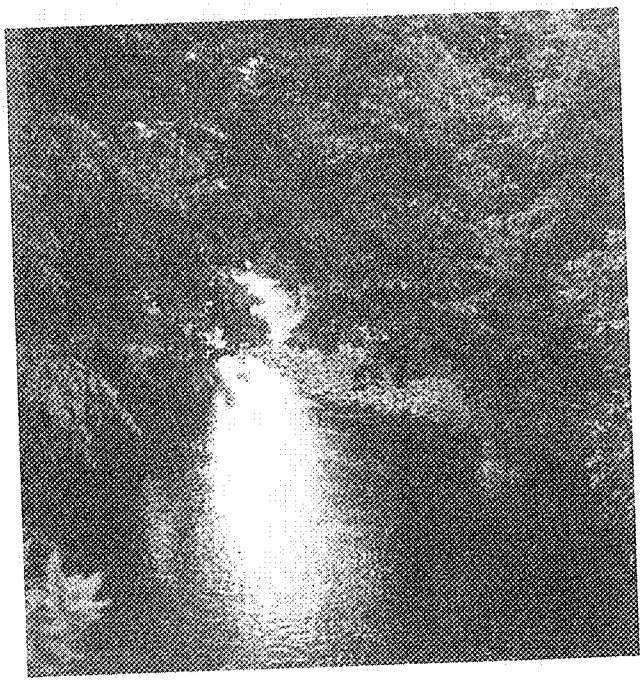


Fig. IV - 7

ZONE II: AYERS BROOK (Open Meadow Brook to Tributary G).

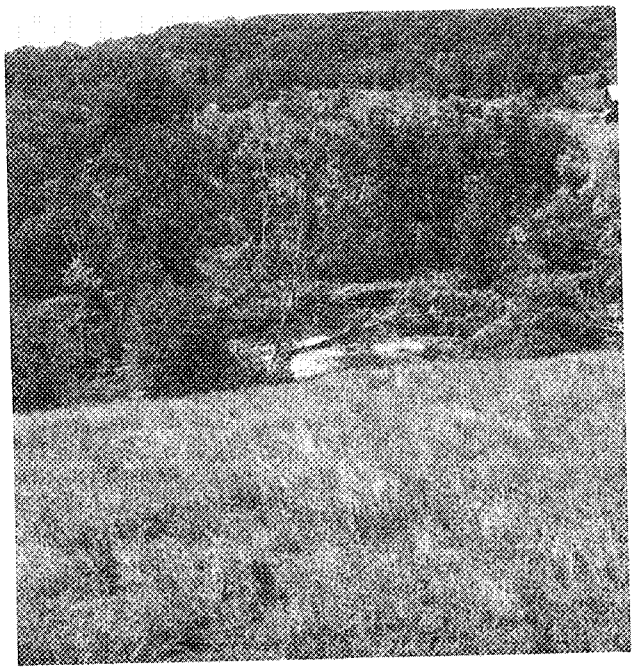


Fig. II - 13

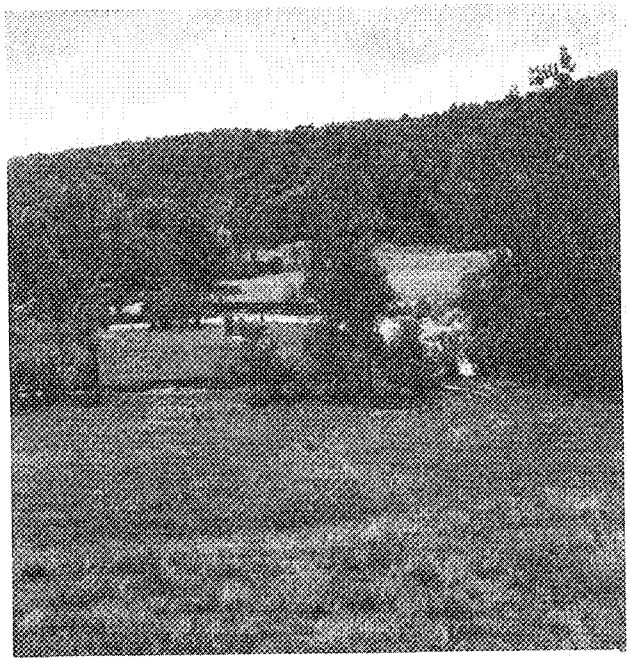


Fig. II - 14

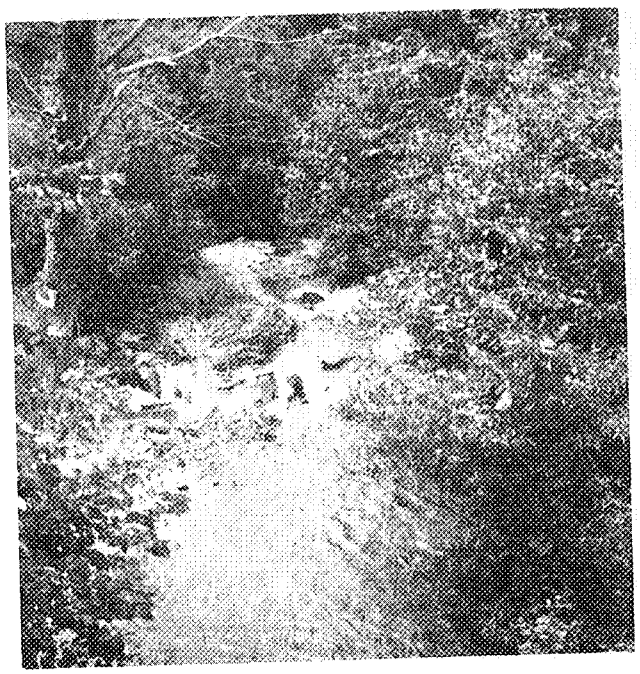


Fig. II - 15

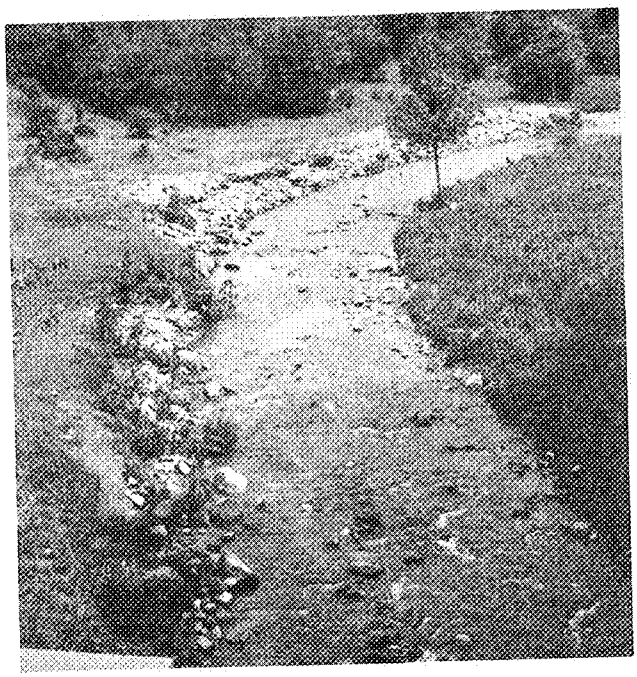


Fig. II - 16

ZONE III: AYERS BROOK (Tributary G to Tributary B).

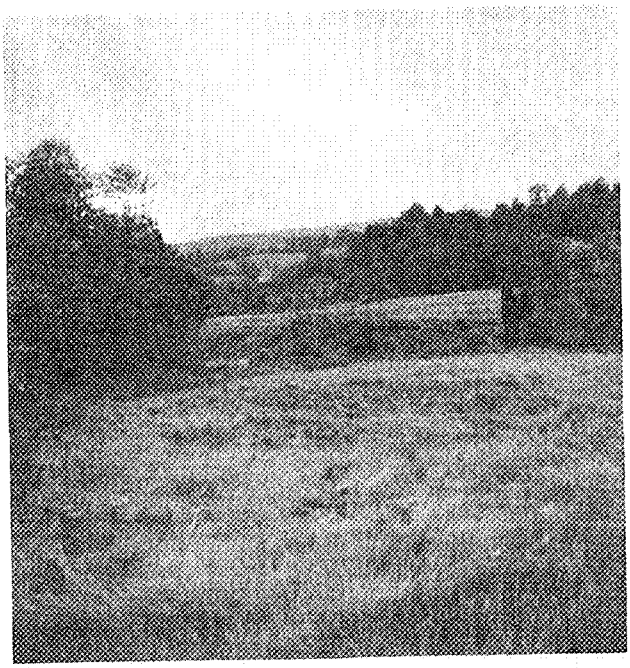


Fig. III - 1

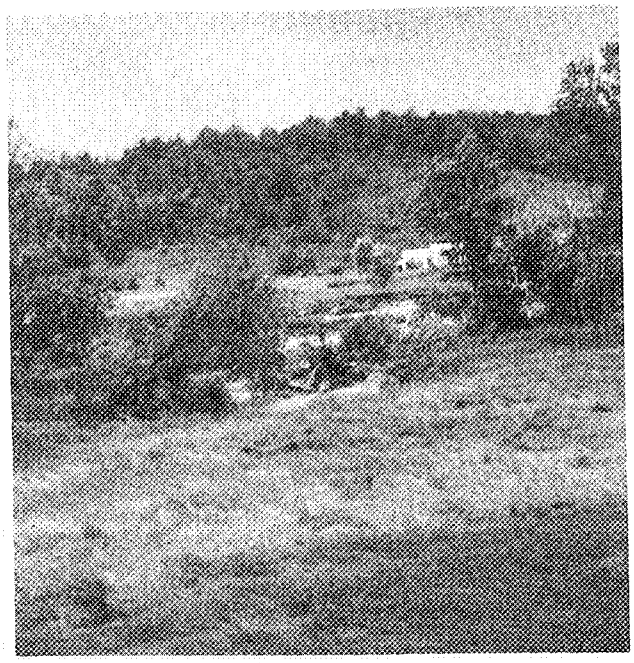


Fig. III - 2

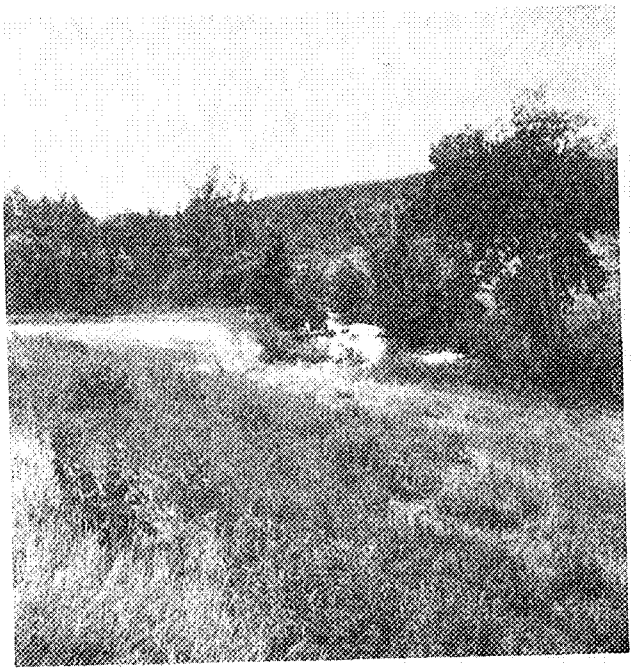


Fig. III - 3

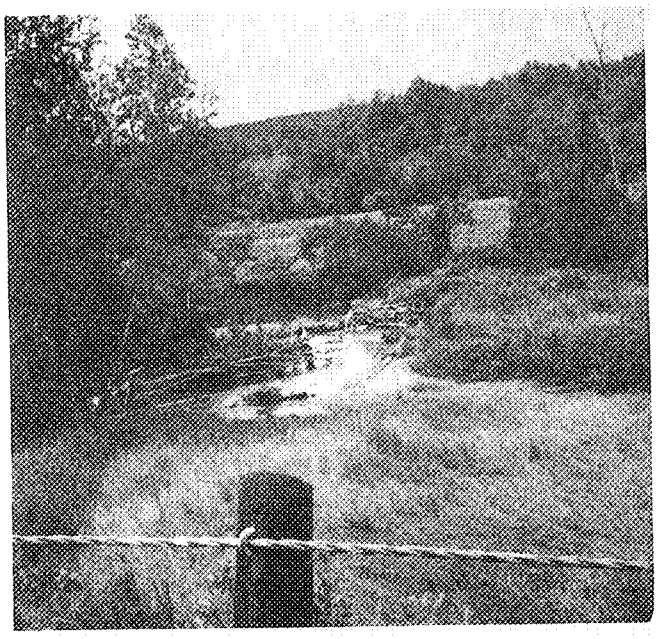


Fig. III - 4